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**MILL CREEK BASIN, KING COUNTY, WASHINGTON**

**AQUATIC RESOURCES RESTORATION PLAN**

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DRAFT

JUNE 1997

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**U.S. ENVIRONMENTAL PROTECTION AGENCY**

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## **ORGANIZATION OF THE MILL CREEK AQUATIC RESTORATION PLAN**

This plan is comprised of five chapters as follows:

Chapter 1 - Introduction - Restoration Goals

Chapter 2 - Existing Conditions

Chapter 3 - Restoration Plan Overview

Chapter 4 - Site-Specific Restoration Recommendations

Chapter 5 - Implementation of the Restoration Plan

RP Appendix A - Relationship of the Restoration Plan to Existing Plans

RP Appendix B - Wetland Community Types

Chapter 2 focuses on describing the basin, and identifying existing significant resources. This identification of existing significant resources is presented to set up "red flags" to restoration designers, so that proposed restoration plans are not presented which seriously impact existing resources. Because a particular area is not identified as having a significant resources does not mean that the area does not have value. In fact, such areas have potential for greater amount of improvement compared to areas that are already relatively high quality. The restoration potential of a site is more tied to its landscape position and hydrology than to the presence of significant resources. In cases where good habitats exist, these features should remain, with restoration efforts focusing on enhancing other areas that are poorly functioning.

Chapter 3 briefly describes the process by which a measure of the restoration potential of sites was developed, as well as how restoration actions for individual sites were developed. It also describes an overall framework for how individual restoration actions can be pieced together to form a complete system.

Chapter 4 is the heart of this document, describing individual restoration actions which can occur on sites.

Chapter 5 summarizes the process and describes ways to implement the plan.

## **RELATIONSHIP TO EXISTING PLANS**

The Mill Creek Basin has been the focal point of several plans oriented towards improving one or more functions in the basin (i.e. flood control; water quality). These plans include the following documents which are also described in **RP Appendix A**:

- Mill Creek Water Quality Management Plan Green-Duwamish Watershed Non-Point Action Plan
- Auburn Comprehensive Drainage Plan
- Kent Water Quality Management Plan
- Mill Creek Flood Control Plan
- Green/Duwamish Watershed Fisheries Management Process
- Green/Duwamish Watershed Restoration General Investigation
- Green/Duwamish Ecosystem Report
- Mill Creek Basin Reconnaissance Report (1987)



## **Definitions**

**Anadromous** - species, such as salmon, that hatch in fresh water, spend a large part of their lives in the ocean, and return to fresh water to reproduce.

**Aquatic Resources** - All waters, water habitats and the organisms found in them including lakes and ponds; streams and rivers including adjoining riparian areas which they affects; marshes, swamps, and other wetlands

**Barrier** - An obstruction or other water condition which prevents the movement of organisms through the aquatic environment. The term is especially used to describe impediments to fish passage in streams.

**Basin** - A geographical area that drains to a major water body such as a river, lake, or creek, which is usually the water body for which the basin is named.

**Best Management Practices (BMPs)** - A method, activity, maintenance procedure, or other management practice for reducing the amount of pollution entering a water body.

**Buffer** - a designated area adjacent a stream or wetland that is an integral part of the stream or wetland ecosystem. The critical functions of a buffer (associated with an aquatic systems) include shading, input of organic debris and coarse sediments, uptake of nutrients, stabilization of banks, interception of fine sediments, stormflow attenuation during high water events, protection from disturbance by humans and domestic animals, maintenance of wildlife habitat, and room for variation of aquatic system boundaries over time due to hydrologic or climatic effects.

**Buildout** - A state in which land is developed more or less to the full extent permitted by zoning and other regulatory constraints.

**Clean Water Act** - A Federal law which establishes standards and procedures for limiting the discharge of fill and pollutants into waters of the United States.

**Compensatory Mitigation** - Is the restoration, creation, and preservation of wetlands and/or other aquatic resources for the purpose of compensating for adverse impacts on an aquatic resource that caused by a permitted project or activity.

**Corridor** - A continuous, linear area in which organisms, seeds, water, sediments, and nutrients can move uninterrupted and naturally from one end of the area to the other, or portions thereof.

**Creation** - The conversion of a persistent non-aquatic site into an aquatic site. For the purpose of this plan, creation includes the conversion of sites which currently do not meet the definition of a wetlands, even though these sites were wetlands prior to being permanently drained and/or covered by fill.

**Current Use Taxation (CUT) Program** - A King County program in which property taxes are assessed based on the value of the current use of the property rather than its highest and best use. If the use is changed to a “higher” use, the property owner must pay the back taxes that would have been paid at the “higher” rate for up to the last 10 years if the property had not been assessed at the CUT rate.

**Delineation** - A determination of the boundaries of a wetland or other aquatic site.

**Ditch** - A long narrow excavation dug to carry water. Sometimes natural streams are excavated and turned into ditches. Especially in the case of larger streams, streams so treated may continue to be called streams rather than ditches.

**Enhancement** - Actions taken to add an aquatic function(s) which did not previously exist at an aquatic site.

**Excavation** - For regulatory purposes, this includes the removal of any material from an aquatic site in which there is at least an incidental redeposit of the material into the aquatic site.

**Federal Wetland Reserve Program** - A Natural Resources Conservation Service program that funds conversion of private agriculture, range, and forest lands back to wetlands.

**Fill (Filling)** - The material used for the primary purpose of replacing an aquatic area with dry land or of changing the bottom elevation of a waterbody.

**Floodplain** - The land adjacent to a stream or lake, built of alluvium and subject to repeated flooding.

**Floodway** - The channel of a river or stream and those portions of the adjoining floodplains that are likely to carry and discharge the 100-year flood; it is generally associated with rapidly flowing water.

**Goal** - A general statement of an end towards which effort is to be directed

**Indicator Value Assessment Method (IVA)** - A numeric, rapid assessment method for establishing the relative values of wetlands in regional planning. The method combines qualitative understanding of how local wetlands function with assessments of their regional values.

**In-Kind Replacement** - Providing or managing substitute resources to replace the functional values of resources lost, where such substitute resources are also physically and biologically the same or almost the same as those lost.

**Inventory** - Refers to a list of wetland sites whose boundaries have been roughly delineated.

**King County Sensitive Area Ordinance** - King County Ordinance 9614 and rules that identify environmentally sensitive areas (coal mine, erosion, flood, landslide, seismic, steep slope, and volcanic hazard areas, and streams, wetlands, and protective buffers) and supplement the development requirements contained in the various use classifications in the King County Code by providing for additional controls.

**Large Woody Debris** - Trees, in whole or part, that fall into the stream from the banks or float downstream until they lodge in the channel. Large woody debris provides variety in the local habitat, temporary sediment storage, and dissipates the energy of flowing water.

**Mitigation** - See Compensatory Mitigation.

**Mitigation Sequencing** - Provisions in the EPA Section 404(b)(1) Guidelines (40 CFR 230.10) which promulgate a mitigation policy requiring avoidance and minimization of adverse impacts on the aquatic environment before compensatory mitigation may be considered.

**Nationwide Permit** - A general permit that allows individuals and companies to discharge small amounts of fill into waters of the United States in situations where adverse impacts normally would be minimal. Nationwide permits have been issued for several categories of activities including wetland restoration projects, maintenance of existing facilities, road crossings, bank protection, and fills 3 acres or less in size in the headwaters of watersheds.

**Objective** - A specific statement of the level or condition to be obtained when a related goal is accomplished. Attainment of an objective is directly measurable while attainment of a goal is indirectly assessed through measurement of specific objectives related to the goal.

**Open Water Body** - In the SAMP, open water bodies consist of lakes and ponds. With most lakes in the area there is a surrounding wetland fringe and/or vegetated shallows which along with the open water compose the “wetland system.”

**Public Benefits Rating System (PBRs)** - A scoring system based on a property’s natural resource and open space qualifications which the tax assessor uses to estimate current use property value.

**Practicable** - Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

**Recommendation** - An action which should be taken to attain an objective.

**Regional Detention Facilities** - See stormwater detention facilities.

**Restoration** - Actions taken which result in the re-establishment of aquatic site structure, processes, and functions in areas where the aquatic site has been altered, degraded, or destroyed.

**Salmonid** - A fish of the family Salmonidae. Some salmonids common to King County are chinook, coho, and sockeye salmon; cutthroat and rainbow trout; and Dolly Varden char.

**Section 404 (b)(1) Guidelines** - Regulations promulgated at 40 CFR 230 by EPA in accordance with Section 404(b)(1) of the Clean Water Act tell how EPA and the Corps will evaluate proposals for the discharge of fill into waters of the U.S. Department of Army permits may be issued only if they comply with the Guidelines. Generally, discharges of fill are allowed under the Guidelines only if no other environmentally less damaging practicable alternative is available, no significant degradation of the waters, no adverse impacts to threatened and endangered species, and if appropriate and practicable steps have been taken to minimize adverse impacts on the aquatic ecosystem.

**Spawning Habitat** - Aquatic habitats where fish can lay and fertilize their eggs. For salmon these are usually areas with stable pea-sized gravel substrate through and over which cool, well oxygenated water is flowing.

**Stormwater** - Surface water that is found in streams and depressions in direct response to a specific storm event.

**Stormwater Detention Facility** - Ponds, ditches, or other water holding areas which can store or help infiltrate enough runoff to reduce peak flows that cause flooding and or erosive damage in streams. Sometimes these facilities include oil-water separators, bio-filtration areas, or other means of cleaning dissolved and or suspended pollutants carried by stormwater runoff.

**Stream** - An area where surface waters produce a defined channel or bed. A defined channel or bed is an area that demonstrates clear evidence of the passage of water and includes, but is not limited to, bedrock channels, gravel beds, sand and silt beds, and defined-channel swales. The channel or bed need not contain water year-round. This definition is not meant to include irrigation ditches, canals, storm water runoff devices or other entirely artificial watercourses unless they are used by salmonids or used to convey streams naturally occurring prior to construction. Those topographic features that resemble streams but have no defined channels (i.e. swales) should be considered streams when hydrologic and hydraulic analyses done pursuant to a development proposal predict formation of a defined channel after development.

**Technical Oversight Committee** - The TOC would be an interagency committee with responsibility, among other things, to review compensatory mitigation plans. It would not have independent decisionmaking authority of its own, but two of its members -- the Corps and the relevant local government —would have such authority . The TOC would also include regular advisory members: the EPA, NMFS, WDE, and the MIT. As needed, the TOC would draw on other organizations and public agencies for expertise and advice.

**Watershed** - See basin.

**Wetland Rating System** - A Washington State Department of Ecology method of rating wetland habitat suitability.

**Wetland** - Areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

**Wetland Evaluation Technique (WET)** - A technique for establishing correlations between field indicators of (1) the extent to which a wetland performs wetland functions (e.g. flood

attenuation, water quality improvement, fish and wildlife habitat); (2) the extent to which there are opportunities for the wetlands to perform these functions; and (3) how much value society places on the performance of these functions.

**Wetland System** - For the purposes of this plan, system refers to two or more separately mapped wetlands or other aquatic resources which function together.

### **Acronyms**

**BMP** - best management practices

**BOD** - biological oxygen demand

**CFR** - Code of Federal Regulations

**COE** - (U.S. Army) Corps of Engineers

**CUT** - (King County) current use taxation (program)

**EIS** - environmental impact statement

**EPA** - (U.S.) Environmental Protection Agency

**FEMA** - Federal Emergency Management Agency

**FWS** - (U.S.) Fish and Wildlife Service

**GMA** - Growth Management Act (Washington State)

**HPA** - Hydraulic Project Approval

**IVA** - indicator value assessment method (explained in appendix C)

**KCC** - King County code

**MIT** - Muckleshoot Indian Tribe

**MOA** - memorandum of understanding

**NAIOP** - National Association of Industrial and Office Parks

**NPDES** - National Pollution Discharge Elimination System

**NRCS** - U.S. Natural Resources Conservation Service (formerly U.S. Soil Conservation Service)

**NWP** - nationwide permit

**O&M** - operation and maintenance

**PBRS** - public benefits rating system

**R.M.** - river mile

**SAMP** - special area management plan

**SAO** - (King County) Sensitive Areas Ordinance

**TOC** - (Mill Creek SAMP) Technical Oversight Committee

**WAC** - Washington Administrative Code

**WDFW** - Washington State Department of Fish and Wildlife

**WDOE** - Washington State Department of Ecology

**WET** - wetland evaluation technique

**WRIA** - water resource inventory area

## **1. INTRODUCTION**

### **1.1 PURPOSE**

The purpose of this restoration plan is to provide guidance for restoration and enhancement of the aquatic resources in the Mill Creek/Mullen Slough Basin. The Mill Creek/Mullen Slough basin covers approximately 22 square miles in the lower Green River valley in King County, Washington (**Figure 1-1**).

This plan describes background data, a description of the process by which restoration and enhancement potential was established, an overall plan for restoring and enhancing the basin ecosystem, a description of recommended actions for individual sites, and design ideas for implementing this plan on individual wetlands and tributaries. This report describes restoration and enhancement opportunities in the basin, and is not tied to any specific planning actions or development activities. The recommended actions are intended to establish an interconnected system of restored and preserved wetlands and waterways linked to existing upland habitats.

The restoration plan provides a comprehensive blueprint to guide the location and design of individual compensatory mitigation and independent restoration actions in the basin. While this plan provides recommendations for actions on wetlands, uplands and tributaries in the basin, the actual footprint of these actions will be determined by available funding and the willingness and consent of property owners to participate. So, this plan provides a flexible framework into which individual restoration projects can fit. The success or failure of the plan as a whole does not depend on the inclusion of any single or few wetland properties. The more pieces that are included, the better the chances of restoring a hydrologic regime and range of habitats needed to sustain a variety of aquatic habitats and organisms, and the better that these habitats and organisms can be insulated against excessive human intrusion.

This plan is a living document. As with any other plan operating in a constantly changing environment, and dependent upon multiple participants for implementation, consideration must be given to new information as it becomes available. As the first restoration and enhancement actions come on-line, adjustments may be needed to incorporate recommendations and revisions, and priorities may need to be readjusted.

### **1.2 Relationship Between the Mill Creek SAMP and This Restoration Plan**

This restoration plan is a key component of, but not exactly the same as the Mill Creek Special Area Management Plan (SAMP). The SAMP designates specific wetland and aquatic resource



areas which are appropriate for development and which are appropriate for protection. The restoration plan outlines site-specific and overall restoration measures applicable to all aquatic sites with a high or medium restoration potential regardless of its SAMP designation for development or protection. It is important to note that a major impetus for restoring and preserving basin aquatic sites would be permission granted under the SAMP to fill some wetlands as long as compensatory mitigation would be provided.

### **1.3 WHAT IS RESTORATION, ENHANCEMENT AND PRESERVATION?**

In this plan the terms "restoration", "enhancement", and "preservation" will frequently be used. The term "wetland restoration" refers to actions which result in the re-establishment of wetland structure, processes, and functions where wetlands have been altered, degraded, or destroyed (Gersib et al. 1994). Such actions could include adding hydrology or planting native plant species, or both. However, these types of actions are often considered enhancement in a strict regulatory sense when the site is an already existing wetland in a degraded state. For ease of understanding, the term restoration is used in this plan to include both actions which re-establish as well as enhance aquatic functions. Stream restoration refers to actions taken which result in the re-establishment of stream ecosystem processes and functions. Preservation means that a site is protected from development which would degrade aquatic functions and values. The meaning implies that fee simple purchase, conservation easement purchase, or some type of statutory or regulatory protection would be employed to ensure the protected status. For more information on preserving and protecting existing wetlands refer to Washington State Department of Ecology's Exploring Wetlands Stewardship: A Reference Guide for Assisting Washington Landowners (October, 1996).

### **1.4 NEED FOR AN AQUATIC RESOURCES RESTORATION PLAN**

The restoration plan is a response to the need for a coordinated effort to enhance, restore, and preserve aquatic resources in the basin. Other reasons include:

#### **A. Improve Degraded Habitat and Enhance Aquatic Resources**

The Mill Creek/Mullen Slough drainage basin has experienced significant alterations in its physical makeup over the past 140 years. Despite these alterations, significant wetland (about 2,400 acres) and stream (approximately 15 miles of stream accessible to salmonids) resources remain, though in a degraded state. While these resources provide valued functions for fish and wildlife, water quality, and flood control, there are numerous opportunities to improve their function.

## B. Improve Fisheries Resources

Mill Creek and Mullen Slough are among the few major tributaries on the lower Green River which has unrestricted access for fish. The mouth of the river is not obstructed by a floodgate, and fish have access to the creek and slough at all times, including when the Green River is in flood stage. The creek and slough provide a significant refuge and rearing habitat for both adult and juvenile salmonids from the creek, slough, and Green River. Improvements to Mill Creek, Mullen Slough, and their tributaries would not only enhance the fish habitat in the creek and slough, but will also benefit salmonid stocks throughout the entire Green River watershed.

## C. Focus Restoration Efforts to Create a Contiguous System

Since the aquatic resources in this basin have been fragmented, there is a need to focus restoration efforts to create a contiguous system. This plan will help ensure that as independent restoration actions occur they will build upon each other to produce a stronger, more connected, and better functioning ecosystem on a basin-wide scale.

## D. Provide Guidance for Mitigation of Development Actions

Since the majority of the remaining undeveloped lands in the valley contain wetlands, there is a need to identify which wetlands are suitable for enhancement and restoration which could be used as mitigation for future wetland fills covered under the Mill Creek SAMP. This plan will encourage projects which build upon each other to enhance the entire system rather than the current policy which tends to favor in-kind, on-site mitigation, often resulting in piecemeal, isolated mitigation efforts. This piecemeal approach to mitigation has been identified as a contributing factor in the failure of many compensatory mitigation plans.

# 1.5 GOALS OF THE RESTORATION PLAN

The overall goal for the restoration plan is to re-establish an interconnected system of wetlands and adjacent transitional uplands centered on Mill Creek, Mullen Slough, and their tributaries. This will improve fish and wildlife habitat, maintain or improve the water quality improvement functions of existing wetlands and riparian zones, and maintain or increase the flood-storage capacity in the basin. Emphasis would be placed on restoring habitats present before non-native settlement, while not significantly impacting existing resources. Areas where good/high functioning habitats currently exist would be preserved and/or protected, with restoration efforts focusing on areas that are poorly functioning. Areas away from riparian corridors can also be

targeted for restoration and would compliment adjacent riparian areas and provide increased habitat diversity, water quality and flood control functions suitable for the area's position in the basin. Habitat, water quality and flood control have been identified in the SAMP as the primary limiting functions in the Mill Creek/Mullen Slough basin.

To achieve this overall goal, four objectives were used in the development of this plan:

A. Develop restoration options for all basin wetlands, uplands and tributaries, as well as establishing priorities for restoration;

B. In developing restoration actions, consider the importance and location of the site to the entire system and plan for the entire system, not just the individual sites;

C. Use riparian areas as the focal point for enhancing aquatic resources and interconnecting ecosystems. This will increase the value and function of Mill Creek and Mullen Slough as corridors, improve salmonid habitat, and help address high water temperatures due to lack of stream cover and poorly defined channel structure, which is a major water quality problem in the Mill Creek system. Areas away from the riparian corridors should be targeted for restoration measures which compliment adjacent riparian areas and provide habitat, water quality and flood control functions suitable for each area's position in the basin and;

D. Make recommendations to control disturbances to the ecosystem to insure the maintenance of the system. Existing disturbances to the system include:

- Water quality and habitat degradation from point and non-point sources;
- Sedimentation;
- Increases in flooding due to development;
- Spread of exotic plant species displacing native vegetation, and
- Fragmentation of habitat and loss of connectivity between habitat patches.

## **1.6 FORMULATION OF THE OVERALL RESTORATION PLAN**

Considerations In developing this restoration plan consideration was given to existing conditions, the history of the basin, and the restoration goals. While it is a high priority to restore historic wetlands and other aquatic resources to their previous conditions, this may not be possible or beneficial in some areas. Significant disruption of hydrologic conditions which allowed those habitats to function has occurred in some areas. Additionally, restoration to

previous conditions in some areas would significantly disrupt current valuable fish and wildlife habitats (e.g. converting a palustrine emergent wetland to a palustrine forested wetland could compromise overwintering waterfowl habitat of some farmed wetland pastures). Consideration of the position of particular sites in the basin and how those sites connect to other areas is also important in determining what types of restoration actions will be recommended with restoration efforts focusing on enhancing other areas that are not functioning as well. The successful implementation of restoration actions is dependent upon the cooperation of current property owners. Success will be directly related to offering owners adequate compensation for their property and/or other incentives to participate.

### **1.6.1 Return to Historic Conditions**

The restoration of basin wetlands to pre-native settlement conditions (forested wetlands) was identified early in the SAMP process as being desirable for several reasons. The re-establishment of riparian areas would improve water quality moderating temperatures and possibly improve dissolved oxygen (DO). Forested systems with expanded channels (dendrites) would improve fish habitat, and over time increase the supply of large woody debris to Mill Creek/Mullen Slough and their tributaries. Increasing forested systems in the basin would also increase biological diversity of the system, re-introducing some but not all species formerly found in the basin.

### **1.6.2 Reduction Of Fragmentation And Creation Of Large Habitat Areas (Patches)**

Part of the problem with maintaining the Mill Creek/Mullen Slough ecosystem has been habitat fragmentation due to urbanization. Restoration of large areas will help to reduce fragmentation, and provide minimum habitat requirements for both existing and desired indicator species. Large size habitats are more resilient to disturbance, and can harbor more sub-habitats and species (Shreffler and Thom, 1993). Each habitat area cannot be expected to meet requirements for all species by having sufficient large habitat areas designated for individual species. However, the requirements for all indicator species could be met for the basin.

In developing restoration recommendations consideration must be given to the connection of restoration sites to other areas. The connectivity of wetland systems decreases on the valley floor moving from west to east, away from Mill Creek, because of the lack of connecting corridors such as tributaries. From Mill Creek, moving east to west up the hillside onto the plateau, connections between the valley wetlands and the plateau forested wetland systems and lakes are maintained along the tributaries to Mill Creek and Mullen Slough. In developing this Restoration Plan, emphasis was given to restoring wetlands and uplands that have connection to other areas. In addition, an adequate buffer must be provided to assure that the connection functions effectively. However, adequate corridor width is not achievable in many areas due to

the location of existing developments (especially on the western plateau). The largest possible size buffer should be used based on existing land uses. For the Mill Creek and Mullen Slough corridors, a minimum total buffer width of 300 feet is recommended. For other tributaries, a minimum buffer width of 100 feet is recommended.

### **1.6.3 Connectivity Of Sites (Corridor Development)**

As stated before, enhancing riparian areas increases the value of watercourses as corridors, improves salmonid habitat, and addresses a major water quality problem in the Mill Creek/Mullen Slough system; high water temperatures due to lack of stream cover and poorly defined channel structure. Efforts to improve stream corridors will also increase food sources, and the recruitment of woody debris into the stream system. By providing connections between various sites, the function and value of all the sites is enhanced, since they will operate as a unit and not isolated sites.

## **1.7 BASIN OVERVIEW, CONDITIONS, AND PHYSICAL SETTING**

The Mill Creek basin contains significant natural resources as well as being under extreme developmental pressure. The basin is divided into two physiographic regions. There is the valley floor (valley) which is part of the floodplain of the Green River, of which Mill Creek is a tributary. The valley has a large number of emergent wetland systems, and agricultural activities, as well as an expanding industrial base of warehouses and business parks. A large part of the city of Auburn is in the valley portion of the Mill Creek Basin. The valley floor contains approximately 2,000 acres of wetlands, 130 acres of restorable uplands, and approximately 17 miles of tributaries. Mill Creek and Mullen Slough are the primary drainage courses on the valley floor, transporting water from the uplands to the Green River. An extensive system of wetlands serves primarily as habitat for waterfowl and other wildlife and stores water during periods of flooding.

The basin encompasses four significant streams: Mill Creek, Mullen Slough (which drains into Mill Creek), Midway Creek, and Northeast Auburn Creek. These drainages all share a sizable flood plain adjacent to the Green River.

The second physiographic feature is the western plateau and hillside which transition to the valley floor. The western plateau and hillside contain approximately 360 acres of forested wetlands and lakes. Interspersed with these wetlands and lakes are low and medium density residential developments and an associated road network. The plateau in the western half of the basin attains elevations 300 to 400 ft above the valley floor, where the hills have a glaciated relief in which stream courses are often poorly defined. Basins or depressions created by the receding

glaciers are occupied by four major lakes (Dolloff, Fenwick, Geneva, and Star), Bingaman Pond, and numerous wetlands. Mill Creek is the primary water course draining the uplands along with numerous smaller, unnamed streams to the north that converge in Mullen Slough.

Separating the plateau and the valley are steep slopes, which often rise abruptly from the valley floor to form the edge of the uplands. All the streams and tributaries of the plateau flow through short, steep, wooded ravines onto the valley floor to the east. The largest of these ravines is the 1.5-mile long Peasley Canyon, cut by the well-defined Mill Creek channel.

## **1.8 RESTORATION PLAN PRIORITIES**

In selecting among restoration projects, emphasis should be given to building on existing resource areas throughout the SAMP area, prioritizing the Mill Creek/Mullen Slough area from their mouths to their headwaters. The projects would be strung along the creek like pearls on a string, with additions occurring as more restoration projects come on line. At the very least, the Mill Creek/Mullen Slough corridor should be protected with a minimum 300-foot buffer (150 feet on each side of the creek), to facilitate and support wildlife migration between habitat areas. At a minimum, riparian areas should be restored to provide cover and shading of watercourses. For wetlands adjacent to Mill Creek, Mullen Slough, and their principle tributaries, emphasis will be placed on restoring/enhancing fish habitat since improvement of fish habitat will facilitate the improvement of other functions and values associated with the wetlands.

## **1.9 TARGET AUDIENCE/IMPLEMENTATION**

This document is intended to be used by all parties interested in restoring, enhancing, and preserving the Mill Creek/Mullen Slough Basin ecosystem. Developers, planners, agency and tribal representatives, decision makers, and volunteers will have access to information which will aid in the selection of restoration projects targeted to benefit the Mill Creek/Mullen Slough basin ecosystem. This should result in a coordinated effort to restore the basin's resources. No one restoration action addresses all the needs of the system, but each action should improve the system as a whole.

## **2. EXISTING CONDITIONS**

### **2.1 ASSESSMENT METHODOLOGY**

#### **2.1.1 Wetlands.**

The interagency SAMP committee inventoried the location and approximate size of all wetlands in the Mill Creek basin using aerial photo interpretation, limited field verifications, and information from existing inventories (Shapiro 1990b, 1991). Areas that contained indicators of wetland conditions as defined in the Corps' 1989 Wetland Delineation Manual (USACE 1989) were included. The use of the 1989 Manual means that the wetland acreage includes slightly more transitional wetland-upland area has probably been included in the inventory compared what would be included if the inventory were based on the 1987 Manual (USACE 1987), the current Federal and State guide. Paper wetland inventory maps and digital map data were prepared and are maintained and updated by the Seattle District Corps of Engineers.

#### **2.1.2 Streams.**

The interagency SAMP committee also identified and mapped Mill Creek, Auburn Creek, Algona Creek, Mullen Slough, and Midway Creek and nearly all their tributaries. An interagency work group characterized the aquatic habitats in the main creeks and smaller tributaries based on field visits, prior experience and observations, and reviews of water quality data and field work by others. The greatest effort was placed on tributaries likely to support salmonids. Samples of migratory and resident fish populations were taken by Jones and Stokes (1989), Shapiro (1988 - 1989), the WDFW, and the Muckleshoot Indian Tribe (1994-1995 and other occasions).

#### **2.1.3 Wetland Functions and Values.**

For the inventory of wetlands, the interagency SAMP committee estimated wetland functions and values using three techniques: the Wetland Evaluation Technique (WET) (Adamus 1987), the Washington State Rating System (WDE 1993), and the Indicator Value Assessment (IVA) Methodology (Hruby et al 1995). The overall process is explained in the following paragraphs.

**Select Functions to Assess.** The SAMP committee, with the assistance of natural resource professionals from their respective agency technical staffs, identified thirteen prime wetland functions in the basin:

- Floodflow alteration and desynchronization
- Sediment/Toxicant Retention
- Sediment Stabilization

- Groundwater Recharge
- Groundwater Discharge
- Aquatic Diversity/Abundance
- Wildlife Diversity/Abundance
- Wildlife Breeding
- Wildlife Wintering
- Nutrient Removal/Transformation
- Primary Production and Production Export
- Recreation
- Uniqueness/Heritage

**Identify Indicators for Each Function.** The SAMP committee then identified 133 wetland indicators from the Wetland Evaluation Technique (WET) (Adamus 1987) supplemented with 22 indicators used in the Washington State Wetland Rating System (WDE 1993).

**Assign Scores to Indicators.** The SAMP committee numerically weighted each of the wetland function indicators in terms of whether it was a basic indicator, a strong indicator, a very strong indicator, or indicator of a dysfunctional situation. The weighting was based on committee members' best professional judgment and knowledge of basin wetlands.

**Estimate Performance Scores.** Using WET field data collected in 1991 for each wetland and best professional judgment, the SAMP committee then determined which of the 155 indicators of wetland functions were present at each wetland site. Then, using the numerically weighted indicators from the previous step, a raw score was calculated for the importance of each the 12 functions in each wetland.

**Establish the Relative Social Importance of Functions.** The SAMP committee then combined the 12 functions into three equally important function groups: fish habitat, habitat for other species, and water quality improvement. Within each function group, individual functions were accorded the same weight. The SAMP committee considered, but did not adopt the idea of according a relatively greater social significance to one or more functions, and the idea of including a greater number of groups. Recreation and uniqueness functions were not carried forward in this evaluation because the SAMP committee considered them relatively insignificant functions as far as determining whether a wetland should or should not be protected. The floodflow alternation function was also not carried forward because hydrologic and hydraulic information was not available with which to make meaningful assessments of each wetland's contribution to the floodflow function.



**Estimate Value Scores of Wetlands.** After the function groups and the weighting within each group were decided, the value scores for each wetland for each function group were calculated first by normalizing within a function, then adding the normalized scores for a function group together, and re-normalizing. This last score is normalized on a scale of 0 - 100 with 100 representing the highest ranked wetland for a particular function group. It represents the value per acre of a function in a wetland relative to all the other wetlands. The IVA points shown in **Table 2-1** are these values per acre. IVA scores can be calculated for individual wetlands by multiplying this score times the number of acres.

**Stream In-Channel Functions and Values.** Stream channel stability and several scattered fish habitat surveys have been conducted by Shapiro (1989), Jones and Stokes (1989), the Washington Department of Fish and Wildlife (unpublished) and the Muckleshoot Indian Tribe (unpublished data from 1994 and 1995 with some information entered into the Auburn Throughbred Horse Racing Facility Final EIS (USCOE, 1995). However, a comprehensive functional assessment of the Mill Creek basin's streams has not been undertaken.

## 2.2 EXISTING AQUATIC RESOURCES

### 2.2.1 Wetlands

About 2,400 acres of wetlands including open water in 128 separate wetland systems were inventoried (see **Figure 2.1 or 1.1**). Since detailed delineations for individual permit actions have identified more or less wetland acreage on individual parcels, the total wetland acreage listed below is an approximate value, subject to revision as new information is obtained. The current mix of inventoried wetland habitat types is:

Wetland Type Acreage (including Open Water)	
Emergent	1,870
Scrub-Shrub	108
Forested	236
Open Water	213
TOTAL <sup>1</sup>	2,427

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<sup>1</sup> Includes about 83 acres for wetlands 3D, 5I and 3Z which are subject to the city of Auburn's, but not the Corps of

As can be seen from the distribution of wetland habitat types, most of the basin's wetlands are emergent systems. Approximately 1,400 acres of emergent wetlands are in some type of agricultural use, and almost half of that acreage is in the King County Farmland Preservation Program. Of the 236 acres of forested wetlands, as well as the 213 acres of open water, the majority are found in the headwater and hillside areas of the basin. Descriptions of individual wetlands as well as the results of the functions and values assessment conducted for the wetlands are contained in Chapter 4. Existing condition IVA scores for wetland functions and values are also summarized in **Table 2-1**.

**Table 2-1: Existing Wetland Conditions and Restoration Potentials**

Wetland#	Acres	Restoration		Preservation Acres	Target Wetland Type	IVA SCORES - EXISTING CONDITION (points/acre)			IVA SCORES - RESTORED CONDITION (points/acre)			ECOLOGY RATING	
						Other		Water	Other		Water		
		Potential	Acres			Fish	Species	Quality	Fish	Species	Quality	Pts.	Cat.
1A	42.2	LOW	42.2	0.0	FO	45	63	71				37	2
1L	1.5	LOW	1.5	0.0	EM	7	45	44				11	3
1M	0.6	LOW	0.6	0.0	EM	10	47	55				9	3
1N	0.6	LOW	0.6	0.0	EM	10	52	53				11	3
1O	0.2	LOW	0.2	0.0	EM	14	66	61				21	2
1P	0.3	LOW	0.3	0.0	EM	6	29	56				4	3
2A	302.3	AGR	47.0	255.3	FO/AG	56	72	56				37	2
2AAA	2.5	AGR	2.5	0.0	FO	11	49	49				27	2
2B	79.7	AGR	5.0	74.7	FO/AG	23	32	72				17	3
2BBB	1.2	AGR	1.2	0.0	FO	12	67	70				27	2
2C	44.5	HIGH	44.5	0.0	EM/FO	21	27	60	67	78	123	18	3
2CCC	0.6	LOW	0.6	0.0	FO	1	6	16				3	3
2D	174.4	HIGH/AG R	106.0	68.4	FO/AG	64	82	76	89	109	99	38	2
2DDD	0.1	LOW	0.1	0.0	FO	6	42	75				5	3
2E	198.5	HIGH/AG R	106.2	92.3	FO/AG	57	70	55	91	112	92	20	3
2F	8.6	LOW	8.6	0.0	EM	5	21	32				14	3
2FFF	0.9	HIGH	0.9	0.0	FO	11	60	46	13	74	59	24	2
2G	16.1	LOW/AG R	13.4	2.7	EM	6	41	69				19	3
2PP	0.5	MED.	0.5	0.0	OW/FO	17	76	52	14	84	54	33	2
2QQ	3.4	LOW	3.4	0.0	EM	6	36	64				14	3

Wetland#	Acres	Restoration		Preservation Acres	Target Wetland Type	IVA SCORES - EXISTING CONDITION (points/acre)			IVA SCORES - RESTORED CONDITION (points/acre)			ECOLOGY RATING	
						Other		Water	Other		Water		
		Potential	Acres			Fish	Species	Quality	Fish	Species	Quality	Pts.	Cat.
2XX	20.4	HIGH	20.4	0.0	EM	54	54	90	88	87	115	20	3
2YY	1.5	LOW	1.5	0.0	EM	5	34	62				7	4
2ZZ	1.4	LOW	1.4	0.0	EM	42	50	65				11	4
3A	14.7	LOW	14.7	0.0	FO	45	56	80				33	2
3B	4.9	LOW	4.9	0.0	FO	45	46	78				33	2
3C	15.1	LOW	15.1	0.0	EM	8	65	71				11	3
3D	0.0	LOW	0.0	0.0	FO	7	47	50				18	3
3E	5.0	LOW	5.0	0.0	FO	9	59	73				21	3
3N	1.4	LOW	1.4	0.0	FO	5	37	47				19	3
3Q	2.0	LOW	2.0	0.0	EM	2	9	26				6	3
3Z	0.0	LOW	0.0	0.0	EM	10	55	59				30	2
4A	41.5	AGR	0.0	41.5	FO/AG	10	60	87				10	3
4AA	33.2	AGR/LOW	20.0	13.2	FO	8	46	70				17	3
4B	115.1	AGR(9)	0.0	115.1	FO/AG	52	66	100				32	2
4C	15.1	LOW	11.1	4.0	EM	5	37	57				14	3
4D	3.0	LOW	3.0	0.0	FO	6	40	80				9	4
4E	4.1	LOW	4.1	0.0	EM	7	45	72				19	3
4EE	7.7	PRES.	0.0	7.7	FO	35	80	70					
5A	57.1	HIGH	57.1	0.0	FO/SS	56	70	86	105	114	134	28	2
5B	52.4	HIGH*	38.9	13.7	FO	45	55	49	78	85	87	17	3
5C	32.4	MED.	32.4	0.0	EM	48	66	88	77	90	113	21	3
5D	30.2	HIGH	30.2	0.0	EM	10	51	54	20	92	81	15	3
5E	60.0	HIGH	60.0	0.0	FO/SS	60	69	82	87	88	111	25	2
5EEE	77.8	HIGH	55.8	22.0	EM	10	50	74	16	80	82	11	3
5EEEE	7.0	LOW	7.0	0.0	EM	6	32	61				9	3

Wetland#	Acres	Restoration		Preservation Acres	Target Wetland Type	IVA SCORES - EXISTING CONDITION (points/acre)			IVA SCORES - RESTORED CONDITION (points/acre)			ECOLOGY RATING	
						Other		Water	Other		Water		
		Potential	Acres			Fish	Species	Quality	Fish	Species	Quality	Pts.	Cat.
5F	5.9	LOW	5.9	0.0	EM	5	29	50				13	3
5FFF	0.7	LOW	0.0	0.7	EM	7	43	69				14	3
5G	43.6	HIGH	43.6	0.0	FO/SS	63	71	80	95	102	119	17	3
5GG	3.5	FILLED	0.0	3.5	EM	8	51	70				12	3
5H	40.8	HIGH	40.8	0.0	EM	9	54	66	14	98	87	16	3
5I	0.0	LOW	0.0	0.0	EM	7	49	85				23	2
5J	35.0	HIGH	35.0	0.0	EM	56	65	67	90	108	84	15	3
5K	117.4	HIGH*	91.9	25.5	FO/SS	67	69	83	122	129	129	20	3
5KKKK	7.6	PRES.	0.0	7.6	EM	73	82	95				28	2
5L	31.1	HIGH	31.1	0.0	FO/SS	7	47	75	16	67	100	29	2
5LLLL	6.3	PRES.	0.0	6.3	EM	73	82	95				28	2
5M	44.5	MED.	44.5	0.0	EM	9	58	90	14	87	112	24	2
5N	8.7	LOW	8.7	0.0	EM	7	41	44				13	4
5O	3.9	LOW	3.9	0.0	EM	7	42	62				6	4
5P	11.2	HIGH	11.2	0.0	FO/SS	75	70	88	102	106	101	28	2
5Q	26.0	MED.	26.0	0.0	EM	10	55	79	17	94	117	17	3
5R	22.8	PRES.	0.0	22.8	FO	67	73	76				43	2
5S	22.3	PRES.	0.0	22.3	FO	68	73	65				28	2
5SSS	22.4	HIGH	22.4	0.0	EM	8	58	82	17	82	103	16	3
5T	1.9	LOW	1.9	0.0	EM	4	25	59				0	4
5U	7.4	MED	6.7	0.7	FO	7	39	72	14	61	99	21	3
5V	12.8	LOW	12.8	0.0	EM	7	51	56				26	2
5W	24.3	LOW	24.3	0.0	EM	7	51	56				26	2
5XX	0.3	HIGH	0.3	0.0	FO	7	40	59	10	58	68	16	3
5YY	1.1	MED.	1.1	0.0	EM	15	71	49	18	87	74	21	3
5ZZ	3.7	MED.	3.7	0.0	FO	12	70	70	19	102	95	16	3

Wetland#	Acres	Restoration		Preservation Acres	Target Wetland Type	IVA SCORES - EXISTING CONDITION (points/acre)			IVA SCORES - RESTORED CONDITION (points/acre)			ECOLOGY RATING	
						Other		Water	Other		Water	Pts.	Cat.
		Potential	Acres			Fish	Species	Quality	Fish	Species	Quality		
5ZZZ	11.4	MED.	11.4	0.0	EM	6	36	65	15	66	101	16	3
KCLG14	33.8	PRES.	0.0	33.8	OW	78	80	48				13	3
KCLG15	14.4	PRES.	0.0	14.4	OW/FO	67	85	81				46	1
KCLG50	10.8	PRES.	0.0	10.8	FO	64	78	71				38	1
KCLG6	18.9	PRES.	0.0	18.9	OW	94	100	66				38	2
KCMC18	32.4	PRES.	0.0	32.4	FO	15	96	100				35	1
KCMC2	3.1	PRES.	0.0	3.1	EM	22	31	27				6	3
KCMC3	11.0	PRES.	0.0	11.0	FO	100	95	65				33	1
KCMC4	36.0	PRES.	0.0	36.0	OW	76	82	59				32	2
KCMC5	3.2	PRES.	0.0	3.2	FO	12	57	56				17	3
KCMC6	2.7	PRES.	0.0	2.7	FO	10	61	29				28	2
KCMC8	8.0	MED.	8.0	0.0	EM	9	51	43	17	121	80	32	2
KCMC9	33.0	PRES.	0.0	33.0	OW	43	54	75				35	1
SAMP1	1.3	PRES.	0.0	1.3	FO	11	69	38				31	1
SAMP11	0.3	PRES.	0.0	0.3	FO	11	60	57				40	2
SAMP12	7.1	PRES.	0.0	7.1	FO	8	49	34				0	4
SAMP13	0.3	PRES.	0.0	0.3	EM	6	51	23				31	2
SAMP14	12.9	HIGH	2.1	10.8	FO	15	80	59	18	106	81	6	4
SAMP15	3.2	PRES.	0.0	3.2	FO	10	52	48				21	3
SAMP16	0.9	PRES.	0.0	0.9	FO	10	52	48				29	2
SAMP17	1.8	PRES.	0.0	1.8	FO	10	55	45				26	2
SAMP18	2.0	PRES.	0.0	2.0	FO	73	82	53				24	2
SAMP19	0.4	PRES.	0.0	0.4	FO	96	95	67				38	1
SAMP2	2.0	MED.	2.0	0.0	FO	11	68	42	14	80	56	43	2
SAMP20	1.6	PRES.	0.0	1.6	FO	7	47	56				39	2
SAMP21	4.7	PRES.	0.0	4.7	FO	58	64	61				0	4

Wetland#	Acres	Restoration		Preservation Acres	Target Wetland Type	IVA SCORES - EXISTING CONDITION (points/acre)			IVA SCORES - RESTORED CONDITION (points/acre)			ECOLOGY RATING	
						Other		Water	Other		Water		
		Potential	Acres			Fish	Species	Quality	Fish	Species	Quality	Pts.	Cat.
SAMP22	9.9	PRES.	0.0	9.9	FO	81	82	54				32	2
SAMP23	0.6	PRES.	0.0	0.6	FO	5	31	27				29	2
SAMP24	1.5	PRES.	0.0	1.5	FO	14	70	48				12	3
SAMP25	1.1	PRES.	0.0	1.1	FO	9	57	34				31	2
SAMP26	0.6	PRES.	0.0	0.6	FO	7	53	36				31	2
SAMP26A	0.6	PRES.	0.0	0.6	EM	11	57	18				9	3
SAMP27	1.6	PRES.	0.0	1.6	FO	8	52	38				8	3
SAMP28	1.3	PRES.	0.0	1.3	FO	10	54	43				24	2
SAMP29	0.2	PRES.	0.0	0.2	FO	13	62	51				15	3
SAMP3	1.1	PRES.	0.0	1.1	FO	8	47	33				20	3
SAMP30	1.0	PRES.	0.0	1.0	FO	11	44	48				18	3
SAMP31	1.2	PRES.	0.0	1.2	EM	9	69	41				16	3
SAMP32	0.9	PRES.	0.0	0.9	FO	12	54	55				14	3
SAMP32A	0.5	PRES.	0.0	0.5	FO	12	55	55				0	4
SAMP33	13.9	PRES.	0.0	13.9	FO	57	57	48				27	2
SAMP34	0.2	PRES.	0.0	0.2	EM	9	67	42				15	3
SAMP35	4.6	PRES.	0.0	4.6	FO	59	63	66				21	3
SAMP35A	0.6	PRES.	0.0	0.6	FO	8	47	46				0	4
SAMP36	5.7	PRES.	0.0	5.7	FO	12	61	50				27	2
SAMP37	8.0	PRES.	0.0	8.0	FO	88	87	82				28	1
SAMP38	1.4	PRES.	0.0	1.4	FO	11	46	35				23	2
SAMP39	8.0	MED.	8.0	0.0	FO	10	63	51	15	79	64	36	2
SAMP4	2.6	HIGH	2.6	0.0	FO	7	41	23	17	85	63	20	3
SAMP40	1.3	MED.	1.3	0.0	FO	10	59	55	22	110	91	23	2
SAMP41	1.3	HIGH	1.3	0.0	FO	79	75	57	81	93	62	35	2
SAMP42	3.7	PRES.	0.0	3.7	FO	11	58	60				25	1

Wetland#	Acres	Restoration		Preservation Acres	Target Wetland Type	IVA SCORES - EXISTING CONDITION (points/acre)			IVA SCORES - RESTORED CONDITION (points/acre)			ECOLOGY RATING	
						Other		Water	Other		Water		
		Potential	Acres			Fish	Species	Quality	Fish	Species	Quality	Pts.	Cat.
SAMP43	2.5	PRES.	0.0	2.5	FO	72	96	55				39	1
SAMP5	6.4	PRES.	0.0	6.4	FO	15	99	64				39	1
SAMP6	0.9	PRES.	0.0	0.9	FO	8	59	37				23	2
SAMP7	4.8	PRES.	0.0	4.8	FO	11	62	60				35	2
SAMP8	0.8	PRES.	0.0	0.8	FO	11	47	41				24	2
SAMP9	0.7	PRES.	0.0	0.7	FO	8	43	26				32	2
6A	1.9	PRES.*	?	1.9	EM/SS								
6B	8.0	PRES.*	?	8.0	?								
6C	0.5	LOW	0.5	0.0	?								
			1224.2										
Upland#													
UPMC	8.0	HIGH	8.0	0	FO	0	0	0	79	75	68		
UP2CN	16.9	LOW	5.0	0	FO	0	0	0	22	32	47		
UP2CS	17.8	LOW	2.0	0	FO	0	0	0	11	29	55		
UP2XX	43.4	HIGH	43.4	0	EM	0	0	0	87	106	90		
UP3C	11.0	LOW	11.0	0	FO/SS	0	0	0					
UP5G	24.7	HIGH	24.7	0	FO/SS	0	0	0	74	83	93		
UP5J	8.3	MED.	8.3	0	FO/SS	0	0	0	30	45	60		
UP5KN	1.0	MED	1.0	0	EM/FO	0	0	0	3	23	24		
UP5KS	6.7	HIGH	6.7	0	FO	0	0	0	6	40	49		
UP5P	16.4	MED.	16.4	0	FO	0	0	0	42	51	42		
UP5R	2.7	HIGH	2.7	0	FO	0	0	0	40	46	40		
UP5S	12.6	HIGH	2.0	0	EM	0	0	0	47	55	68		

NOTES:

\* = Already preserved under city ordinance or Department of Army Permit as wetland compensatory mitigation site.



Wetland#	Acres	Restoration		Preservation	Target Wetland Type	IVA SCORES - EXISTING CONDITION (points/acre)			IVA SCORES - RESTORED CONDITION (points/acre)			ECOLOGY RATING	
						Other		Water	Other		Water	Pts.	Cat.
		Potential	Acres	Acres		Fish	Species	Quality	Fish	Species	Quality		

EM = Emergent Vegetation (e.g. grasses, lilies, rushes, herbaceous plants)

FO = Forested Vegetation (e.g. woody plants over 20 feet tall)

SS = Shrub/Scrub (e.g. woody shrubs and vegetation under 20 feet tall)

IVA = Indicator Value Assessment Method Score

Preservation Acres = Aquatic sites that do not need much restoration, but should be purchased and protected. Agricultural lands (AGR) in the King County Farmland Preservation Program are considered already preserved.

### 2.2.2 Streams (Mill Creek, Mullen Slough and Tributaries)

The location and extent of the basin's streams is illustrated in **Figure 2.1 (and 1.1)**. These figures show water resource inventory area (WRIA) identification numbers for each main creek and its tributaries. Approximately 6.8 miles of Mill Creek currently provides unrestricted access for salmonids.<sup>2</sup> Conditions in Mill Creek and the lower reaches of its tributaries vary from excellent to unrecoverable. In some places riparian cover and channel morphology provide favorable habitats for aquatic organisms. In other places the creek is channelized and devoid of adequate riparian vegetation. Similar conditions are found on Mullen Slough, Auburn Creek, and Midway Creek. As discussed in more detail in the Water Quality Report (Appendix G), water quality is a problem in many stream segments, particularly summertime dissolved oxygen and temperatures conditions. **Table 2-2** shows the characterizations of Mill Creek and Mullen Slough tributaries.

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<sup>2</sup> The expansion of the Peasley Canyon Road in 1985 and building of an impassable culvert, flume and channelization of Mill Creek removed access by salmonids above the intersection with Peasley Canyon Way (R.M. 6.7). This blockage eliminated access to the upper 1.8 miles of Mill Creek (to Lake Doloff) and several tributaries.

**Table 2-2 - Existing Stream Conditions and Restoration Potential**

Stream Name	Stream Number (WRIA)	Stream Mile	Reach Name	Associated Wetlands <sup>3</sup>	Habitat Quality	Fish Use	Restoration Potential
Midway	09.0043	0.00-0.32	Lower	1A	Poor	Med	Med
Midway	09.0043	0.32-0.60	Middle	1A; UP1A	Fair/Good	Med	Med
Midway	09.0043	0.60-0.85	Upper	-	Fair/Good	Low	Med
Unnamed	09.0043A	0.00-0.10	?	1A	Poor	Low	Low
Unnamed	09.0043B	0.00-0.14	?	-	Poor	Low	Low
Unnamed	09.0043C	0.00-0.22	?	-	Fair	Low	Low
0044AA	09.0044AA	0.00-?	?	1N	?	Hi	Med
0044BB	09.0044BB	0.00-?	?	1O	Fair	?	?
Mullen	09.0045	0.00-0.05	Mouth	2A	Poor	Hi	Med
Mullen	09.0045	0.05-0.34	?	2A	Fair/Good	?	Med
Mullen	09.0045	0.34-1.00	Smith	2A	Poor	Hi	Med
Unnamed	09.0045AA	0.00-0.17	?	2A	Poor	Hi	?
Unnamed	09.0045BB	0.00-0.18	?	2A	Poor	?	Hi
Mullen	09.0045	1.00-1.80	?	2A; 2D	Poor	Hi	Hi
Mullen	09.0045	1.80-2.46	?	2E	Fair	?	Hi
Mullen	09.0045	2.46-2.85	?	3A	Fair	?	Hi
Unnamed	09.0046	0.00-0.23	?	2A; 2D	Good	?	Hi
Unnamed	09.0046	0.23-0.53	?	2D; 2PP	Fair	Hi	Hi
Unnamed	09.0046	0.53-1.00	?	KCLG14	Poor	Low	Hi
Unnamed	09.0046A	0.00-1.65	?	KCLG6; SAMP43	Poor	Hi	Med
Unnamed	09.0045A	0.00-?	?	-	Poor	?	Med
Unnamed	09.0047	0.00-?	?	2E, SAMP38	Poor	?	?
Unnamed	09.0048	0.00-?	?	2E	Fair	?	?
Unnamed	09.0049	0.00-0.36	Lower	SAMP41; KLG15	Fair	Med	?
Mill	09.0051	0.00-0.20	Mouth	-	?	Med	Hi

<sup>3</sup> Including potentially restorable uplands indicated by 'UP' prefix.

Stream Name	Stream Number (WRIA)	Stream Mile	Reach Name	Associated Wetlands <sup>3</sup>	Habitat Quality	Fish Use	Restoration Potential
Mill	09.0051	0.20-0.30	?	UPMC	?	?	Hi
Mill	09.0051	0.30-0.50	?	UPMC	Fair	?	?
Mill	09.0051	0.50-0.90	?	2B,2A	Poor	?	?
Mill	09.0051	0.90-1.50	Smith	2B,2D	Poor	Hi	Hi
Mill	09.0051	1.50-1.80	Carpinito.	2C; UP2CN & CS	Poor	Hi	Hi
Mill	09.0051	1.80-2.30	Schuler.	2XX; UP2XX	Fair	Hi	Hi
Mill	09.0051	2.30-2.50	?	5A	Fair	Hi	Hi
Mill	09.0051	2.50-2.85	?	5B	Fair	Hi	Hi
Mill	09.0051	2.85-3.50	Puget	5E	Poor	Hi	Hi
Unnamed	09.0051CC	0.00-?	BN	5E	Poor	Hi	Hi
Unnamed	09.0051DD	0.00-?	29 St.	UP5G	Fair	Low	Hi
Mill	09.0051	3.50-3.70	Neff	UP5G	Fair	Hi?	Med
Mill	09.0051	3.70-4.10	Merlin	5G	Fair	Hi?	Hi
Mill	09.0051	4.10-4.50	Calhoun	5J	Poor	Hi?	Hi
Unnamed	09.0051F	0.00-0.51	?	5J	Fair	Low	Hi
Mill	09.0051	4.50-4.90	Jones	5K; UP5KN	Fair/Good	Hi?	Low
Mill	09.0051	4.90-5.20	Racet.	5K	Fair	Hi	Hi
Mill	09.0051	5.20-5.55	N.Main	5K; UP5KS	Poor	Hi?	Low
Unnamed	09.0051E	0.00-0.45	Yahn	5P	Poor	?	Hi
Mill	09.0051	5.55-5.60	Main	5P; UP5P		?	Med
Algona	09.0054	0.00-0.35	Lower	5S; UP5R & S	Fair	?	Hi
Algona	09.0054	0.35-0.45	Middle	5KKKK; 5LLLL	?	?	?
Algona	09.0054	0.45-1.8	Upper	5V; SAMP5 & 6	Poor	?	Med
Mill	09.0051	6.20-6.80	L.Peasley	-	Fair	Hi	Med
Mill	09.0051	6.80-7.60	U.Peasley	5R	Poor	Low	Low
NE Aub	09.0056	0.00-0.30	KC OS	-	Poor	Low?	?
NE Aub	09.0056	0.30-0.60	?	4B	?	Low?	?
Unnamed	09.0056A	0.00-0.23	?	4B	Poor	?	?
Unnamed	09.0056B	0.00-0.25	?	4B	Poor	?	?
Unnamed	09.0056C	0.00-0.25	?	4A	Poor	?	?

Stream Name	Stream Number (WRIA)	Stream Mile	Reach Name	Associated Wetlands <sup>3</sup>	Habitat Quality	Fish Use	Restoration Potential
Unnamed	09.0056D	0.00-0.25	?	-	Poor	?	?

### **2.2.3 Agricultural Lands**

About 900 acres in the Mill Creek basin are in the King County Farmland Preservation Program (**Figure 2-2**). Of this acreage, about 650 acres were inventoried as wetlands. These agricultural lands contain salmonid-bearing streams, and are an important wintering waterfowl area for the mid-Puget Sound and lower Green River Valley.

## **2.3 EXISTING AQUATIC FUNCTIONS**

Within the Mill Creek Basin are several areas which already provide significant habitat for fish and wildlife as well as water quality improvement, and flood storage. The presence of significant, high functioning existing habitats influences restoration options at various sites which are discussed in Chapter 3. A listing of significant habitats is in **Table 2-3** and shown in **Figure 2-3**. The significant habitats include the agricultural wetlands and floodway areas at the mouth of Mill Creek and Mullen Slough, the steep, still forested slopes along the west side of the Green River valley, the blue heron rookery in wetland 5R and nearby heron foraging areas, forested areas already preserved as public parks adjacent to open water and wetlands KCMC9 and KCLG6, and wetlands with the potential to help attenuate flood peaks.

**Table 2-3. Significant Resources in the Mill Creek Basin**

Wetland System	Acreage	Forest	Riparian	Open Water	Tributary	Emerg Marsh	Fish	Raptors	Water Fowl	Wading Birds	Shore Birds	Floodwater Storage
1A	42.183	x			x		x					
1L	1.544											
1M	0.611											
1N	0.637											
1O	0.226											
1P	0.279											
2A	302.329		x		x	x	x	x	x	x	x	x
2AAA	2.471		x									
2B	74.735							x	x			x
2BBB	1.239		x									
2C	44.455								x			x
2CCC	0.618											
2D	174.395				x	x	x	x	x	x		x
2DDD	0.065											
2E	198.489				x	x	x	x	x	x	x	x
2F	8.625											
2FFF	0.927											
2G	16.142											
2PP	0.514											
2QQ	3.363											
2XX	20.356											
2YY	1.48											
2ZZ	1.375		x									
3A	14.717											
3B	4.91											
3C	15.055											
3D	0											
3E	5.0											
3N	1.421											

Wetland		Forest	Riparian	Open	Tributary	Emerg	Fish	Raptors	Water	Wading	Shore	Floodwater
System	Acreage			Water		Marsh			Fowl	Birds	Birds	Storage
3Q	1.997											
3Z	0			x					x	x	x	
4A	41.508								x			
4AA	33.224											
4B	115.14		x						x			x
4C	62.012											
4D	3.04											
4E	4.108											
4EE	7.66											
5A	57.063											x
5B	35.225											
5C	32.356											
5D	30.241											
5E	59.959											
5EEE	77.831											x
5EEEE	7.04											
5F	5.9											
5FFF	0.726											
5G	43.585											
5GG	3.5											
5H	40.811								x			
5I	0											
5J	35.03											
5K	117.358						x		x			x
5KKKK	7.611											x
5L	31.09	x										x
5LLLL	6.327											x
5M	44.474											
5N	8.667											
5O	3.895											
5P	11.228		x				x					
5Q	26.036											
5R	22.781	x					x			x		



Wetland		Forest	Riparian	Open	Tributary	Emerg	Fish	Raptors	Water	Wading	Shore	Floodwater
System	Acreage			Water		Marsh			Fowl	Birds	Birds	Storage
5S	22.265											
5SSS	22.417											x
5T	1.89											
5U	7.37											
5V	12.837											
5W	24.336											
5XX	0.291											
5YY	1.071											
5ZZ	3.748											
5ZZZ	11.371											x
KCLG14	33.782			x					x			
KCLG15	14.389	x		x					x			
KCLG50	10.776	x										
KCLG6	18.857			x					x			
KCMC18	32.419	x										x
KCMC2	3.073											
KCMC3	10.997	x	x									
KCMC4	36.034			x					x			
KCMC5	3.234											
KCMC6	2.735											
KCMC8	8.026								x			
KCMC9	32.955			x					x			
SAMP1	1.262											
SAMP11	0.32											
SAMP12	7.114											
SAMP13	0.303											
SAMP14	12.934											
SAMP15	3.151											
SAMP16	0.899											
SAMP17	1.781											
SAMP18	1.981											
SAMP19	0.413											
SAMP2	2.006											

Wetland		Forest	Riparian	Open	Tributary	Emerg	Fish	Raptors	Water	Wading	Shore	Floodwater
System	Acreage			Water		Marsh			Fowl	Birds	Birds	Storage
SAMP20	1.565											
SAMP21	4.737											
SAMP22	9.918											
SAMP23	0.612											
SAMP24	1.508											
SAMP25	1.054											
SAMP26	0.567											
SAMP26	0.606											
SAMP27	1.621											
SAMP28	1.334											
SAMP29	0.157											
SAMP3	1.119											
SAMP30	1.04											
SAMP31	1.18											
SAMP32	0.873											
SAMP32	0.47											
SAMP33	13.906											
SAMP34	0.243											
SAMP35	4.644											
SAMP35	0.577											
SAMP36	5.651											
SAMP37	7.971	x										
SAMP38	1.448											
SAMP39	7.974											
SAMP4	2.589											
SAMP40	1.253											
SAMP41	1.254											
SAMP42	3.735											
SAMP43	2.463											
SAMP5	6.384											
SAMP6	0.906											
SAMP7	4.829											
SAMP8	0.848											

Wetland		Forest	Riparian	Open	Tributary	Emerg	Fish	Raptors	Water	Wading	Shore	Floodwater
System	Acreage			Water		Marsh			Fowl	Birds	Birds	Storage
SAMP9	0.69											
total	2464.76											
OLD#	Acres											
1	30.24											
2												
3	8		x		x		x					
4												
5	16.9											
6	17.8											
7	43.4								x		x	x
7A												
7B												
8												
9	11.0											
10												
11												
12												
13	24.7											
14												
15												
16	8.3											
16A	1.0											
17												
18	6.7											
19	16.4											
20	2.7											
21	12.6											
22												
N.Green-	394.0	x										
M.Green	130.0	x										
S.Green-	100.0	x										

Wetland		Forest	Riparian	Open	Tributary	Emerg	Fish	Raptors	Water	Wading	Shore	Floodwater
System	Acreage			Water		Marsh			Fowl	Birds	Birds	Storage
Gr. River			x									
Mill							x					
Mullen							x					
Heron										x		

### **2.3.1 Fish Habitat**

Despite documented impairments to water quality, Mill Creek supports large numbers of anadromous and resident salmonids. Some are from natural spawning and planted fry, while others appear to be fish that migrate from the Green River. The Washington Department of Fish and Wildlife (WDFW) releases approximately 100,000 coho fry annually into accessible areas of Mill Creek and at the outlet of Peasley Canyon. Natural spawning of coho has been documented throughout the system, including Mullen Slough. A recent survey found approximately 50 adult coho in Mill Creek in the lower portion of Peasley Canyon. Despite low dissolved oxygen values in the stream, large numbers of less than year-old juvenile coho are also found throughout Mill Creek in July and August, although initial research indicates that the numbers drop off in early September (Jones & Stokes 1989). Limited sampling during July and August suggests that less than year-old juvenile coho reared in Mill Creek tend to be larger than those reared in the Green River (Muckleshoot Indian Tribe, per. com.). Cutthroat trout use Mill Creek in the lower Peasley Canyon for spawning and rearing.

Mill Creek provides overwintering habitat vital to the survival of salmonids. Jones & Stokes (1989) found that coho, chinook, cutthroat trout, and steelhead juveniles migrate into Mill Creek as the Green River flows increase in the fall and winter. Mullen Slough and its tributaries also provide overwintering habitat to juvenile coho. Because no spawning coho were found in Mullen Slough (Shapiro 1989), it is likely that those overwintering are fall immigrants from the Green River. Juvenile salmonids remain in their winter habitats until spring when they smolt. Low numbers of immigrant steelhead and cutthroat were present in the lower reaches of Mullen Slough during the Jones & Stokes (1989) survey. Cutthroat trout in the upper tributaries are believed to be year-round residents.

### **2.3.2 Waterfowl Habitat**

The U.S. Fish and Wildlife Service (USFWS) conservatively estimates that 5,000 waterfowl overwinter in the Green River valley. The SAMP area appears to support up to 2,000 ducks during the winter, approximately 40 percent of the USFWS's estimated wintering population of waterfowl using the Green River valley. The most common species of waterfowl observed in the SAMP area were American wigeon, mallard, northern pintail, green-winged teal, and Canada goose (Shapiro 1989). In 1995, approximately 5,000 northern pintails were observed in the Mill Creek Basin during the Audubon Society's Christmas bird count.

Five areas of waterfowl concentration have been observed during periodic Audubon Society censuses in the basin area. Two are located south of South 277th Street, two on Smith Brothers Dairy Farm (north of South 277th Mullen Slough, and Mill, Auburn, and Midway Creeks and

their tributaries are an important refuge and rearing area for fish in the lower Green River. Mill Creek basin streams provide the largest unrestricted access for fish of any drainage in the lower Green River between the mouth of the Duwamish River and the confluence with Soos Creek (RM 33.65).

Street, one close to this road, the other adjacent to the East Valley Highway), and one south of Highway 516 adjacent to Mullen Slough. Approximately 90 percent of the waterfowl observations within the study area occurred in these sites. Two studies completed in the spring of 1988 investigated areas considered prime for breeding waterfowl. The results indicated that five species of waterfowl including, mallard, Canada goose, blue-winged teal, cinnamon teal, and pintail utilize the study area during the breeding season. Breeding pairs of waterfowl were observed on Mullen Slough, in the wet agriculture habitats adjacent to Mullen Slough, on the Smith Brothers Dairy Farm, and in wet pastures south of South 277th Street (Shapiro 1989). Actively farmed wetlands used by wintering waterfowl include wetlands 2A, 2B, 2D, 2E, 2XX (and upland 2XX), and 4B. Other significant areas for wintering waterfowl, are the lakes on the western plateau and hillside including aquatic sites KCLG6, KCLG14, KCMC4, KCMC4, and KCMC9.

### **2.3.3 Other Wetland-Dependent Species Habitat**

Except for birds, the location, extent and regenerative condition of populations of amphibians, insects, crustaceans, and other wildlife have not been systematically surveyed. Wetland and mitigation plan studies, local SEPA documents, Washington Department of Fish and Wildlife, King County Department of Natural Resources, Muckleshoot Indian Tribe fishery surveys, college and high school student studies, conservation organization censuses, and local water quality studies are sources of scattered, limited time and place surveys and anecdotal information that is available about these populations in the basin. Based upon the findings from these sources, the Mill Creek basin WET surveys, and our knowledge of such populations in other parts of the State, we know the presence of water and abundant vegetation in wetlands and riparian corridors is indicative of existing or potentially productive habitat for these kinds of organisms in terms of the amount of food produced and substrates in or on which organisms depend for survival (reproduction, rearing, foraging, and resting).

Certain SAMP area wetlands are believed to support populations of rough-skinned newts, red legged frogs, northwestern salamanders, long-toed salamanders, and Pacific tree frogs. These amphibians have habitat needs ranging from seasonal pools to permanently inundated areas. Each species requires certain types of vegetation and other conditions for laying eggs and survival of its nymphs or tadpoles. Western toads, western pond turtles, and painted turtles are less likely to be found in the area. Water quality in Mill Creek may be a limiting factor for pollutant-sensitive amphibians. All of these amphibians depend on aquatic habitats for all or a portion of their life cycle.

About 90 species of birds have been recorded, including 29 species of waterfowl referred to in the preceding section, passerine (i.e. songbirds), shorebirds, wading birds, and raptors. Of these species, many are water dependent and use the wetland habitat of the Mill Creek basin as migrating, breeding, and overwintering grounds (King County 1993). Wet meadows are important hunting grounds for raptors. The larger ponded wetlands are important resting and feeding locations for passerine birds and waterfowl, which in turn provide forage for those species that prey upon birds. Forested wetlands containing snags provide both valuable perching locations for raptors and habitat for cavity nesting birds and mammals. Yellow-billed cuckoos depend on riparian areas vegetated in black cottonwood.

The location of the Mill Creek/Mullen Slough corridor along the Pacific Flyway makes it an important stopover and overwintering area for migratory birds. Waterfowl are also seasonally abundant on the open-water lagoons, marshes, streams, and lakes. Rails, common yellowthroat, marsh wren, and orioles are found in the forested swamps. Lesser yellowlegs, dowitchers, western sandpiper, and least sandpiper use the corridor as a stopover during migration (Ehrlich et al. 1988).

Existing emergent wetlands provide feeding areas for great blue heron and other wetland dependent species. A great blue heron rookery is located near the outlet of Peasley Canyon along Mill Creek adjacent to Wetland 5R. The birds congregate in late February at the beginning of the nesting season and remain in the rookery until late August when the young fledge. At other times of the year, herons are solitary and spend much of their day foraging for fish and amphibians along wetlands, streams, rivers, and lakes. The rookery contained as many as 50 nests near the outlet of Peasley Canyon in the Mill Creek basin in 1996. This large bird is considered a priority species in areas that are used for breeding. Great blue herons are listed as a State candidate threatened and endangered species by the WDFW.

Large open areas (wetland and upland) provide feeding habitat for various raptors which occupy the valley. Raptors such as red-tailed hawks, northern harriers, and short-eared owls which nest in the western plateau and hillside greenbelt and take advantage of the large open areas for hunting. The bald eagle and the peregrine falcon have been sighted in the Mill Creek basin and are currently on the Federal threatened and endangered species list.

#### **2.3.4 Existing Greenbelts/Riparian Areas**

Large forested areas exist on the hillside greenbelt. This greenbelt is a significant and large habitat area, approximately 624 acres in size, which is in part protected by the King County Sensitive Area Ordinance (SAO), and City of Auburn regulations for building on steep slopes. On the western plateau there are also several large patches of upland forest which are connected

to other areas by tributary streams and associated riparian corridors. Good riparian habitat also exists along some areas of the Green River.

### **2.3.5 Floodflow Alteration**

Most of the wetlands in the basin perform flood storage functions by absorbing and storing surface waters, thereby reducing peak flows by slowly releasing storm water. This helps protect vital fish and wildlife habitat from damage due to erosion and sedimentation caused by rapid runoff from urban impervious surfaces. As noted in the FEMA floodway mapping (1995), several emergent wetland areas exist in the basin which provide significant floodwater storage. The agricultural areas adjacent to South 277th St. and west of highway 167 function as backwater areas for the Green River. These areas are the largest backwater areas remaining in the lower Green River watershed. Wetlands 2A, 2B, 2C, 2D, 2E and 2XX, and upland UP2XX are included in these backwater areas (see Chapter 4 for more detailed information about these specific areas).

In addition, several other significant floodwater storage areas are identified on the FEMA map, the Mill Creek Flood Control Plan (Phase II), and the city of Auburn Comprehensive Drainage Plan. North of South 277th Street adjacent to the Green River is a storage area which encompasses primarily Wetland 4B (which is in the Farmland Preservation Program) and parts of Wetlands 4A and 4C. Some sections of the wetlands adjacent to 277th Street and State Route 167 (5A), and between 15th Street Northwest and State Route 18 adjacent to Highway 167 (5EEE, 5SSS, and 5ZZZ) have also been identified as providing significant floodwater storage, and as such, have been recommended for development into regional floodwater detention facilities. The wetlands directly west of the Supermall of the Great Northwest in Auburn (5KKKK and 5LLLL) are also identified as providing significant floodwater storage.

### **2.3.6 Sediment Trapping**

The sediment trapping function of wetlands helps to protect the food chain by decreasing turbidity that can reduce light penetration into the water, thereby reducing the depth of the photic zone (Shapiro 1989). Turbidity reduces primary production and decreases fish food. Heavier sediments, which are not trapped in wetlands, can enter the streams and smother bottom dwelling invertebrate populations on which fish and some mammals depend. This affects animals in the food chain that depend on fish as a food source. Sedimentation is a major problem in anadromous fish spawning and rearing habitat.

### **2.3.7 Water Quality**

Wetland systems in the basin filter water flowing through them, enhancing the quality of the water which ultimately outlets into the Green River. The water quality improvement function is



not restricted to wetlands, but increases in importance as the size of the upland or wetland increases and the amount of pervious land available for this function in the basin decreases.

Lake Dolloff and Lake Geneva, headwaters of Mill Creek, and Lake Fenwick and Star Lake, headwaters of Mullen Slough, function as settling basins by removing a significant amount of the pollutants from stormwater that enters the lakes from watershed areas upstream (King County 1993).

Valley wetlands, particularly those adjacent to urban areas, function as filters by removing pollutants such as suspended sediment and nutrients. Currently, filtering occurs only during relatively infrequent, large storms when Mill Creek and Mullen Slough flood high enough to overtop their banks. Until they approach South 277th Street, water in the deeply channelized creek and slough only pass around the edges of the bordering wetlands (King County 1993).

Wetlands in the valley floor retain winter precipitation near the surface as perched ground water. This benefits water quality in waterways by sustaining creek flows during the summer. The cooler ground water lowers water temperatures but may be low in dissolved oxygen (DO). Maintaining summer stream flows results in more available aquatic habitat for numerous aquatic animals. Valley wetlands also replenish aquifer recharge areas by slowing down flood waters long enough for the water to seep into the ground instead of running off through ditches or over impervious surfaces (Green River Basin Program 1978). When water runs off into rivers, it is lost for human consumption. Nutrient and sediment retention improves water quality, while productivity transport benefits organisms using detritus that flows through or falls into moving water.

Agricultural pollution, residential and industrial waste, channelization, and flood control of the waterways have all contributed to poor water quality in Mill Creek and Mullen Slough. Dissolved oxygen (DO) levels for Mill Creek and Mullen Slough consistently fail to meet Washington State Class A standards, which are set at 8.0 mg/liter. All areas in the Mill Creek basin had DO readings higher than the Federal standard of 5.0 mg/liter except Mullen Slough. Overall, DO levels appear to be depressed in the mainstems of Mill Creek and Mullen Slough and somewhat higher in their tributaries (Jones & Stokes 1989). Water quality data do not indicate that high temperatures are a problem in Mill Creek or Mullen Slough except during summer months. Higher temperatures are especially noticeable in areas where vegetative stream bank cover is lacking and where water movements are sluggish, such as Mill Creek south of South 277th Street (Shapiro 1989). A number of fish kills have been recorded in the SAMP area in the recent past. In many cases, the cause of these kills is not known. Some of the kills have been linked to dairy waste, sewage, paint, waste oil, and organic debris constrictions (King County 1993).

WDE designates all creeks in the Mill Creek basin as Class A excellent water quality (King County 1993; Shapiro 1989); however, water quality has become degraded throughout these creeks and their tributaries. The Municipality of Metropolitan Seattle (METRO) Draft Priorities for Water Quality (METRO 1989) cited Mill Creek as a current problem area. The Mill Creek basin is designated as a Critical Drainage Basin (METRO 1989). METRO's sampling station near the mouth of Mill Creek exhibits the lowest overall water quality of the 44 sites currently monitored in the Green River valley (METRO 1989). Poor water quality is evidenced more in the lower reach of Mill Creek, from the mouth to SR 18, than in the upstream (Peasley Canyon) reach. The most significant problems are low dissolved oxygen levels, high summer water temperatures, erosion of stream banks, high fecal coliform counts, and high nutrient concentrations. In addition to these problems, other factors affecting water quality include high turbidity, channelization of the creeks, and high levels of nutrients, including ammonia, nitrate, and phosphorous. Elevated concentrations of metals have exceeded water quality standards, particularly during storm periods (King County 1993). Channel constriction by debris is a problem in some stream areas, as well as heavy growth of reed canarygrass (*Phalaris arundinaceae*) along the streams. The associated accumulations of organic material contribute to depressed dissolved oxygen levels. As a result of some of these problems, fish habitat has been lost or degraded in certain portions of these streams and their tributaries (Shapiro 1989).

## **2.4 HISTORIC CHANGES IN THE MILL CREEK BASIN**

To set restoration goals for the basin, some understanding must be gained as to the changes that have occurred in the basin. The Mill Creek basin has gone through several stages of development, each of which has supported different species and aquatic resource functions. Before non-native settlement, the area was believed to be primarily forested wetlands formed by flooding of the Green and White Rivers.

After non-native settlement, large areas of forest were cleared for agricultural use. Along with these habitat changes wildlife species shifted from forest species (megafauna such as bear, deer and mountain lions), to species such as waterfowl, shorebirds, and raptors which utilize open areas. While species dependent upon open areas were most likely not present in large numbers before clearing took place, the cleared areas became a significant resource in the mid-Puget Sound region for several species dependent upon open areas and the active manipulation which keeps these disturbed areas in a non-forested state.

Hydrology in the valley was progressively altered through channelization and drainage of tributaries and wetlands in the valley, the diversion of the White River (1906), and the building of Howard Hanson Dam (1962). These significant hydrologic alterations may have changed that conditions of

the valley floor which may no longer be able to support habitat types that existed prior to non-native settlement (pre-1850).

However, the areas adjacent to Mill Creek (the majority of which happens to be as far away from the historic channel of the Green River as is physically possible) still flood on an annual basis, so there is hope of restoring forested conditions in some areas. In reviewing the 1940 aerial photos (Corps of Engineers, 1940), old meander scars from the Green River are not visible "close" to Mill Creek, except in the areas north of 277th St. NW close to the confluence with the Green River. Meander scars are evident in other parts of the basin near the Green River. Based on historic records (Shapiro, 1990), "wall to wall" flood conditions probably did not occur every year (most definitely not after the White River diversion in 1906), and more likely the major hydrologic regime for most of the upper and Middle Mill Creek Basin was defined by the creek itself and not the Green River. Likewise the area downstream of South 277th St. still receives overbank flows from the Green River and is still under the influence of the Green River<sup>4</sup>

With the completion of Howard Hanson Dam (flood control) in 1962 and the METRO Interceptor Sewer line (infrastructure support) in 1977, industrial infilling was encouraged and the agricultural landscape transitioned into an urban landscape intermixed with abandoned croplands and pastures, many of which subsequently reverted to higher quality emergent, and scrub-shrub wetlands. In some places Mill Creek and Mullen Slough were diverted from their natural channels, and put into straight channels. Construction of State Route 167 and expansion of the existing road network further altered the landscape. A road expansion in Peasley Canyon blocked anadromous fish passage to Lake Doloff and channelized the creek in the canyon. On the western plateau and hillside, increased residential development removed large blocks of forested areas and greatly reduced riparian zones along watercourses. This ongoing fragmentation of the landscape currently

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<sup>4</sup> In fact, the lower section of Mill Creek is contained in regulatory floodway and is the only large (greater than 100 acres) area in the lower Green River Valley where this occurs. The flood regime of the river has definitely changed with the diversion of the White River and the regulation of the river flows by the Corps of Engineers.

limits where interconnections between former elements of the larger system can be restored. .<sup>5</sup>

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<sup>5</sup> In 1979, local governments in the Green River watershed commissioned a study of the Green River system to identify existing resources and process which shaped the Green River valley. The resultant report was titled “A River of Green”. Of most significance to the restoration plan, the “River of Green” identified significant habitat areas in the valley. Some of these areas still exist, while others have been developed. This 1979 snapshot provides an indication of habitat losses over the last 18 years.

### **3. RESTORATION PLAN OVERVIEW**

#### **3.1 RESTORATION POTENTIAL ASSESSMENT METHODOLOGY**

##### **3.1.1 Wetlands**

During the wetlands functions and values assessment (WET) (1990-91), field biologists evaluated possible restoration actions which could occur on each wetland and the probability of success. These evaluations were based upon the biologists' best professional judgment. Each wetland was evaluated as an independent stand-alone project.

In 1992, based on the biologists' field data and a recent review of wetland restoration literature, the interagency SAMP committee identified sites with restoration potential as ones that could meet all or most of the criteria listed below. Wetlands, which were already functioning relatively well and could not be restored a great deal more, were included as good candidates for preservation. A ranking of high, medium, low, or preservation was given for each wetland (**Figure 3-1**).

- **Reliable Hydrology/Water Regime** - restoration would be possible only where there would be an at least a seasonally reliable water source and a soil type that would help retain water on the site. These features would ensure that hydrophytic vegetation and aquatic organisms could be readily re-established and maintained on a site with a high chance of success.
- **Proximity or Connectedness to Mill Creek, Mullen Slough, and Larger Tributaries** - streamside wetlands and riparian areas generally tend to have substantial restoration potential for in-stream aquatic habitat including detrital transport, water quality improvement, and floodflow alteration functions. Location of a site within the 100-year floodplain and/or the presence of salmonids in streams adjacent to a wetland was a further indicator of a site's good restoration potential. The presence of these indicators meant there were potential opportunities to modify stream structure and add dendrites to improve the aquatic habitat.
- **Not Adversely Affected by Proximity to Existing Development** - a wetland's long-term maintenance, sustainability, and ecological processes can be adversely affected by impervious surface water runoff, public access and encroachment, limited or lack of seed source for natural recruitment, and unreliable water sources which may be "robbed" by adjacent developments.
- **Relatively Low Existing Wetland Functions and Values** - In general, the most promising candidates for restoration actions were areas in which one or more functions were

rated low. Such sites had the greatest potential for improvement provided the other criteria could be met.

- **Greater Than 10-Acres** - While not an absolute requirement, size was important because the full range of habitat needs of several different species could be accommodated and more restoration actions could be accomplished on larger sites.

The restoration potential for each wetland identified as having high and medium restoration potential was quantified as follows. First, each wetland's score in each function group for existing (baseline) conditions was determined. Second, each wetland's score in each function group was determined assuming that each wetland's functions had been restored to their full potential. Third, the difference between the baseline and restored condition IVA scores was calculated for each function group. These differences represent the net improvement (gain) resulting from wetland restoration. The methodology used to estimate compensatory mitigation ratios on a plan basis are summarized in **Chapter 5.2.3** of the main SAMP report. This ratio varies among the plans depending on how many acres of relatively high scoring wetland would be designated for development in a given plan. Generally the ratios are around 3:1 (i.e. 3 acres of restored wetlands required for each acre of wetland filled for development).

### **3.1.2 Uplands**

In 1994, the interagency SAMP committee used aerial photos, land use maps, and field trips to identify 23 parcels containing 318 acres of vacant or under-utilized uplands in the valley which potentially could be restored to wetland conditions. To be included, the parcels had to be underlain by hydric soils, have a reliable, at least seasonal water source, and be either undeveloped or contain structures which could be easily removed. The interagency SAMP committee did not attempt to identify uplands potentially suitable for restoration on the western plateau and hillside. Based on a closer examination of the technical feasibility of removing old fill and restoring wet conditions, the initial list of 23 upland sites was reduced to 12 totaling 131 acres (**Figure 3-2**).

### **3.1.3 Tributaries (including Mill Creek and Mullen Slough)**

In-stream restoration measures were developed by the interagency SAMP Committee based on a review of stream restoration literature and previous stream structure and aquatic life surveys. Supplemental aquatic life and stream structure data was also collected. Fishery biologists from various public agencies and private firms not active on the interagency SAMP committee were

also consulted. Recommendations were developed in two formats: one, site-specific recommendations summarized in Chapter 4; second, a description of typical restoration measures/techniques summarized in the last section of this chapter and in the Mill Creek Flood Control Plan, Phase II.

## 3.2 THE RESTORATION PLAN

### 3.2.1 Overview

The SAMP area (both the valley, and western plateau and hillside), contains a total of about 2,400 acres of wetlands and uplands that can potentially be restored or preserved. This figure does not include the hillside greenbelt or large blocks of upland forest in the western plateau area. Roughly 1,200 acres out of the 2,400 acres are not practicably restorable either because restoration is generally restricted by the King County Farmland Preservation Program or because existing wetlands already function at a high level and could not be further restored. About 1,200 acres of wetland are practicably restorable of which about 1,000 acres have a high or medium restoration potential. In addition, about 114 acres of former wetlands, now converted to uplands, have a medium or high restoration potential. **Figures 3-3 and 3-4** show the minimum and maximum extent restoration plans. **Table 3-1** shows the acres of restored and preserved wetland by cover type associated with each. **Table 2-1** shows restored-condition IVA scores for wetlands and uplands with medium and high restoration potential compared to current-condition IVA scores.

**Table 3-1 Restoration Acreage by Proposed Cover Type**

Cover Type	Action	Minimum	Maximum <sup>6</sup>	
<b>Forested/Scrub Shrub Wetland</b>	Restore	300	800	
	Preserve	200	200	
<b>Emergent/Open Water Wetland</b>	Restore	50	500	
	Preserve <sup>7</sup>	900	900	
<b>Greenbelt</b>	Preserve	300	300	

<sup>6</sup> Includes 113 acres of wetlands.

<sup>7</sup> Includes lands in floodway, Farmlands Preservation Program, existing compensatory wetland mitigation sites.

For ease of describing the restoration plan, the basin is broken into two parts: (1) the valley floor, and (2) the western plateau and hillside. General restoration recommendations are described below for subareas of the two physiographic regions. Recommended restoration actions for individual wetlands and streams are summarized in **Table 3-2** and outlined in detail in Chapter 4.

Wetlands in the King County Farmland Preservation Program (2A, 2B, 2D, 2E, 4A, 4B,) have high restoration potential. However, deed restrictions extant when this report was prepared, preclude any major restoration effort on these parcels without a buyout of development rights. Consequently, these wetlands received low ratings for restoration potential. In the future, these parcels may become available for restoration. In the meantime, it should be possible to restore small portions of these sites within the limits proscribed by the Farmland Preservation Program.



**Table 3-2. Restoration Actions for Wetlands**

### **3.2.2 Valley Floor**

#### **A. King County Farmland Preservation Lands**

There are about 900 acres of agricultural land in the King County Farmland Preservation Program in the Mill Creek Basin of which 650 acres have been inventoried as containing wetlands. Deed restrictions on land managed under this program exclude it from development and limit habitat restoration actions to a small percentage of the total acreage. The cropland can be planted with annual crops intended for wildlife consumption.

Existing agricultural areas already function as valuable wildlife habitat. The best wintering waterfowl and raptor areas are found on lands preserved under the King County Farmland Preservation Program. Because of the continued disturbance due to tilling and grazing, open areas suitable for waterfowl, shorebirds and raptors are maintained in the basin. Without this continual disturbance, this habitat would disappear to be replaced by successional scrub-shrub habitat, and eventually forest. The proximity to the northern segment of the hillside greenbelt, and riparian areas along the Green River also encourages the use of this area by animals dependent upon open areas for feeding and forested areas for breeding such as red-tailed hawk, and possibly bald eagle.

The maintenance of an economically viable, environmentally sensitive agribusiness in the Mill Creek Basin can be used to benefit existing species dependent upon open areas, as well as improving habitat for fish and water quality. The strategy for restoration of agricultural lands is to enhance riparian areas and active farmland not in the farmland preservation program through plantings and addition of large woody debris, and to work with farmers to make the remaining farmland more compatible with fish and wildlife through changes in management practices. Specific measures include fencing livestock out of riparian areas; managing grazing areas jointly for waterfowl and livestock as outlined in various guides published by Ducks Unlimited, the Natural Resources Conservation Service, and the U.S. Fish and Wildlife Service; subsidizing the planting of patches of grains or other waterfowl foods; and restoring riparian habitat.

#### **B. Mouth of Peasley Canyon**

The mouth of Peasley Canyon also forms a core area which should be preserved through protective easements, and where possible enhanced. This area contains the largest remaining salmonid spawning habitat in the Mill Creek system, as well as a large great blue heron rookery. This area is also adjacent to the middle and southern segments of the hillside greenbelt. Wetland 5R, and Uplands 5R and 5S are included in this segment.

### C. Mill Creek Corridor Wetlands and Streams

Prime corridor restoration sites include wetlands 5A, 5B, 5E, 5G, 5K, 5L, 5P, and uplands UP5G, UP5J, UP5KN, UP5KS, UP5P, UP5S, and UP5R.<sup>8</sup> Preservation of the existing hillside greenbelt also is highly desirable to assure a connection between the plateau and the valley, as well as provide upland habitat. Protecting and restoring all of these wetlands in substantial blocks of land as shown in **Figure 3-4** would help minimize impacts from human intrusion and provide at least the minimum habitat area and variety needed by such once common forest-oriented species as the pileated woodpecker (WDFW, 1992) and the yellow-billed cuckoo. The yellow-billed cuckoo was once found in the region and has since been extirpated due to habitat loss.<sup>9</sup> Other animals whose habitat requirements could form a detailed design basis for restoring wetlands and streams are listed in **Table 3-3**.

**Table 3-3. Possible Target Species for Restoration:**

Coho salmon (Salmonid Habitat)
Pacific Salamander (Amphibian Habitat)
Red-legged Frog (Amphibian Habitat)
Western Pond Turtle (Pond Habitat)
Short-tailed Weasel (Emergent Marshes)
Great Blue Heron (Emergent Marshes)
Virginia Rail (Emergent Marshes)
American Widgeon (Wintering Waterfowl)
Blue-winged Teal (Breeding Waterfowl)
Dunlin (Migrating and Wintering Shorebirds)
Willow Flycatcher (Riparian Forest)
Yellow-billed Cuckoo (Riparian Forest)
Northern Harrier/Short-eared Owl (Open-field Habitat)
Pileated Woodpecker (Forest)

To improve fish and wildlife habitat to its full potential and to help manage flooding, a two-stage channel (see location in **Figure 1-1**) would be constructed from about 20th Street NW to the

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<sup>8</sup> The boundaries of the Mill Creek corridor are defined in paragraph 4.2.8 of the main Mill Creek SAMP report.

<sup>9</sup> Yellow-billed cuckoo requires riparian habitat at least 300 feet wide and in a minimum of 10-acre blocks (WDFW, 1992).

mouth of Mill Creek consisting of a smaller summer low flow channel up to about 10 feet wide within a 70-foot wide flood conveyance channel. The flood conveyance channel would be roughly 2 feet lower than the present ground surface and portions would be frequently flooded during the fall and winter months when Mill Creek flows would exceed the capacity of the summer flow channel. The two-stage channel would be part of a minimum 200-foot wide forested and shrub-scrub riparian area some of which would also be wetland. Interspersed in these forest areas would be ponds and meadows suitable for great blue heron feeding and other wildlife (Rodrick, 1991). The summer flow channel would be sinuous with bank overhangs, pools, runs, woody debris, and side channels (dendrites) to improve and diversify habitat for fish and other aquatic life. Riparian plantings and (single-) channel reconfigurations for aquatic habitat improvement would also be undertaken along Mullen Slough, the upper valley of Mill Creek, and tributaries.

In addition, because of the proximity to the hillside greenbelt, ponds suitable for amphibian breeding could be built in wetlands 5K, 5P, and 5S, and their associated uplands (see Richter, 1996). These amphibian breeding areas could be connected to upland areas used by amphibians in other life stages through the use of low fabric fences and road culverts designed to direct passage of amphibians under existing roadways (e.g. West Valley Highway).

Once established, the forest system would require less maintenance than an emergent system. The additional cover along Mill Creek and its tributaries would act to decrease temperature, possibly raise dissolved oxygen levels, and potentially act to reduce sedimentation and eutrophication. Preserving and reforesting relatively large tracts rather than just a forested buffer along Mill Creek, would have the advantage of restoring wetland habitat that has disappeared throughout much of the region for forest-oriented species. The interspersed of emergent meadows and ponds would be especially important for herons in the heron rookery in wetland 5S which would use them for foraging. The proximity to the forest greenbelt would also aid species oriented to forest systems.

Emergent systems would be emphasized in wetlands 2XX (and associated upland UP2XX), 5J, 5S, and the northern part of 5K. System 2XX represents an important wintering waterfowl area. The other systems have water regimes which favor emergent systems. In all cases where emergent systems are emphasized, a forested riparian corridor with a minimum width of 150 feet would be established either side of the Mill Creek.

The wetland systems adjacent to State Route (SR)167 (wetlands 5K, 5L and 5EEE) between 15th St. NW and W Main St. function now as floodwater storage areas. This function can be expanded by excavation of existing low areas and adjacent uplands, and encouraging the growth of dense

emergent vegetation to increase streamflow resistance. A portion of this area contains the mitigation site for the Emerald Downs Racing development.

#### D. Off-Corridor Wetlands

Off-corridor wetlands (i.e. wetlands not contiguous to Mill Creek and Mullen Slough including 5EEE, 5C, 5D, 5H, 5M, 5Q, 5KKKK, and 5LLLL) would be restored as high quality emergent systems buffered by trees and shrubs. In some areas, installation of water control structures would be an appropriate measure for helping to restore and maintain emergent systems as would removal of drainage tile. Deep ponds could also be constructed to improve water quality, increase floodwater storage, and improve habitat for raptors, waterfowl, and wading birds. Water, including pre-treated stormwater, would be held in wetlands with limited springtime fluctuations at depth of 3 to 6 inches through at least April. Deeper depths and greater fluctuations would be possible during winter months because biological activity would be at a minimum and therefore would not be adversely impacted. Streams and ditches in most off-corridor wetlands would not be suited for restoration as salmonid habitat. Site specific investigations and baseline data will be needed to determine the appropriateness of these methods for water retention on each site.

#### E. Tributary Streams (including Mill Creek and Mullen Slough)

Although potential spawning habitat exists at the break in slope, steep gradients on the hillside combined with other blockages limit potential fish use further upstream. **Table 2.2** shows the restoration potential of various stream segments in the basin. Chapter 4 explains site-by-site restoration recommendations.

### 3.2.3 Western Plateau and Hillside Area

For the western plateau and hillside area, the goal of the restoration plan is to preserve as much of the forested systems as possible, and preserve and enhance the corridors which connect these areas. There are approximately 360 acres of wetlands and lakes on the western plateau, and 13 miles of tributaries. Passage of salmonids up to the plateau is restricted, so fisheries considerations are different than in the valley. However, restoring and maintaining the plateau and hillside tributaries, riparian corridors of such tributaries, and the ecological integrity of them and their headwater wetlands is critical in order to maintain downstream functions (such as prey base resources, natural hydrologic regime, sediment transport, and nutrient recycling) which fish and other wildlife depend upon. Preservation and improvement of buffers around wetlands and streams is recommended to improve water quality, wildlife migration, and other stream

functions. Voluntary actions should be encouraged to protect and maintain as much of the uplands surrounding the headwaters, and to maintain and restore as much buffer area around wetlands, lakes and streams as possible (see buffer references). By preserving the remaining peat bogs and open areas on the plateau, water quality impacts from future development would be reduced.

#### A. Lakes

There are 11 ponds and lakes comprising about 125 acres on the plateau. Enhancement of lake habitat through improvements to water quality should be undertaken, as is being done with Lake Fenwick (i.e. no mowing to the lake edge, allowing natural vegetation to re-establish along the lake edge, and placement of woody debris). Habitat enhancements on the lakes for waterfowl should also be considered due to their importance as wintering waterfowl habitat.

#### B. Forested Wetlands

About 200 acres of the plateau and hillside wetlands are forested systems most of which are of high enough quality to preserve as habitat patches. Buffer improvement combined with acquisition of adjacent undeveloped upland habitat is recommended. The exception to this is wetland SAMP39, which can also be enhanced through additional plantings and land use controls.

#### C. Emergent Systems

Emergent systems on the western plateau and hillside total about 40 acres and for the most part can be enhanced to serve as habitat for waterfowl and herons (KCMC 8, SAMP4), or converted to forested systems (e.g. SAMP22, KCMC4).

### **3.3 OTHER ACTIONS**

#### **3.3.1 Control of Sources of Disturbance**

In addition to implementing restoration of wetlands, uplands, and tributaries in the basin, efforts should be made to control disturbances to the system which produce negative effects. Those disturbances include:

- Degradation of water quality from point and non-point sources as well as upland land clearing;
- Sedimentation caused by land clearing and development;

- Increases in flooding due to build-out and;
- Spread of exotic plant species displacing native vegetation.

The best controls would be measures recommended in the Mill Creek Water Quality Management Plan (King County, 1993) including especially measures to control releases of pollutants and sediment in the upper basin. Control measures would include reducing sediment input to Peasley Canyon to protect a key spawning area. Implementation of the city of Auburn Comprehensive Drainage Plan will also help to reduce loading from pollutants washed from impervious surfaces. Implementation of the Mill Creek Flood Control Plan could reduce the frequency and extent of the flooding of barnyards and pastures where animal manure is applied. The sources of disturbance are directly due to increased build-out (land clearing and development). Curbing upland land clearing and development (e.g. habitat degradation) is the key to the solution of being able to restore and maintain the aquatic ecosystems. Finally, increases in floodwater could be partially ameliorated by implementing the flood control plan when completed, combined with further land use restrictions to reduce the increase in impervious surfaces, and fragmentation of the system.

Exotic plant species also have to be controlled to eliminate disturbances to native systems. In certain cases, the elimination of annual disturbances such as tilling and removal of vegetation may actually help native systems recover.

### **3.3.2 Maintenance**

Once established, the forest system would require less maintenance than an emergent system. This expectation is supported by the historic record which shows that Mill Creek Basin was dominated by forested systems before non-native settlement occurred. The natural tendency for forest vegetation to re-establish itself is evidenced by the fact that agricultural lands begin reverting back to shrub-shrub and forest species sometimes after only 3 years after cropping ceased, except in very wet locations. Therefore, the emphasis on restoring the majority of restoration sites to forest or scrub-shrub conditions would reduce costs of long-term maintenance because wetland systems in the basin have a tendency to move towards this cover type in the absence of plowing and fire, and exotics such as reed canarygrass can be partially controlled through shading.

Although emergent areas may require varying degrees of grazing, plowing, burning, prolonged flooding, herbicide application, or selective removal of woody vegetation to maintain the emergent condition, the cost and effort may be warranted as part of the cost of compensatory mitigation for "naturally" self-maintaining emergent wetlands. It also may be warranted by the importance of maintaining habitat for wildlife including migrating and resident waterfowl.

### 3.4 OPTIONS FOR RESTORING WETLANDS AND STREAMS

Outlined below is a listing of potential restoration actions which can be used in enhancing or restoring Mill Creek and Mullen Slough wetlands and streams. The purpose of this listing is to briefly describe the techniques, and point the reader/designer (the intention is that this would be done by a wetlands ecologist, fisheries biologist, engineer and/or other qualified personnel) to possible resources. Some techniques apply only to wetland or stream restoration. Several of the techniques must be used in conjunction with other techniques (e.g. restoration of riparian vegetation will probably be combined with some excavation of stream structures). Other techniques may exist but this listing covers the major restoration actions that are possible in the Mill Creek basin. If a designer has other ideas for restoration, the proposed techniques should be peer-reviewed for possible use in the Mill Creek basin.

It needs to be emphasized that detailed site specific baseline data must be obtained to direct actual site specific design. This data may go much beyond the level of information provided in the SAMP and this restoration plan as outlined below. Most important will be specific baseline data on the surface and sub-surface hydrologic regime of a site. Additionally, detailed topographic mapping may be needed to ascertain what grading plan elevations should be relative to the site's hydrologic characteristics. The ideas and options expressed in this restoration plan are conceptual and are intended to be used as a template for the reader. Wetland restorers may also find it useful to consult three local references: Restoring Wetlands in Washington (WDE, 1993); A Citizen's Guide to Wetland Restoration (EPA, 1994); and Guidelines for Developing Freshwater Wetlands Mitigation Plans and Proposals (WDE et al., 1994). These publications provide good guidance on factors to be included in restoration plans.

The restoration options categories discussed in the following sections include:

- Vegetation;
- Structural Habitat Diversification;
- Topographic Alterations;
- Hydrologic Alterations;
- Fish Passage Improvements;
- Public Access;
- Agricultural Best Management Practices and;
- Agricultural Lands Enhancement.



### 3.4.1 Vegetation

The most definitive source of information on wetland plant community types and species appropriate for the Mill Creek basin is the Department of Natural Resource's (Linda M. Kunze) Preliminary Classification of Native, Low Elevation, Freshwater Wetland Vegetation in Western Washington (DNR, 1994). A section on mineral soil based wetlands from this reference is attached in **RP Appendix B**. Another section of the DNR report which is not attached, contains descriptions of sphagnum bog plant communities and species. This might be useful for restoring some plateau and hillside wetlands.

Several good sources exist which describe planting techniques, and characteristics of plants which can be used for both wetland and riparian restoration projects. Of particular use are Restoring Wetlands in Washington (WDE, 1993), A Citizen's Guide to Wetland Restoration (EPA, 1994), Guidelines for Bank Stabilization Projects (King County, 1993), and Fish Habitat Enhancement A Manual for Freshwater, Estuarine and Marine Habitats (Adams and Whyte, 1990). The compensatory mitigation site plan for the Emerald Downs (1994) is a good example within the basin of how different vegetation classes can be integrated into the existing environment.

1. Restore Riparian Vegetation - This action involves planting native trees and shrubs directly adjacent to Mill Creek, Mullen Slough and tributaries. The purpose of this action is to: 1) provide stream cover to aid in temperature moderation; 2) potentially shade out reed canarygrass; 3) provide additional cover and food sources to enhance the tributaries as migration corridors and connections to habitat patches; and 4) aid in the recruitment of woody debris for stream systems. An understory of shrubs would also be planted as well as coniferous trees which hopefully would dominate the system in the long-term to recreate conditions before non-native settlement. The width of the restored riparian corridor would vary. A minimum of a 100-foot wide stream corridor is recommended to aid in wildlife migration (DesBonnet et al, 1994). At a minimum, to get mitigation credit for this action on tributaries, the buffer would have to be at least 50 feet on each side of the tributary (25 feet in cases where existing land uses do not allow for a larger buffer). A more detailed discussion on mitigation ratios and credits can be found in Chapter 5 of the main SAMP report. On Mill Creek and Mullen Slough the riparian buffer should be a minimum of 150 feet on each side of the creek (preferably 300 feet) except where existing land uses prevent this. The purpose of this larger buffer is not only to protect the stream and provide a migration corridor, but also to provide habitat for breeding. For example, the yellow-billed cuckoo requires riparian habitat at least 300 feet wide in a minimum of 10-acre blocks (WDW, 1992). A listing of suitable riparian plantings including habitat values,

adaptability to wet conditions, and maximum heights may be found in Appendix I of the Mill Creek Water Quality Management Plan (1993).

2. Restore Emergent Vegetation - This action involves planting native herbaceous plants in wetlands either to enhance the existing emergent cover or provide an understory for a scrub-shrub or forested system.

3. Restore Scrub-Shrub Vegetation - This action involves planting native shrubs in a wetland or wetland buffer either to provide an understory for a forested system, or to create or enhance a scrub-shrub system.

4. Re-establish Forested System - This action involves conversion of a scrub-shrub wetland to a forested system. In the short-term the area would be dominated by deciduous species. In the long-term, coniferous species would tend to dominate. In all cases both trees and understory would be planted. Restoration or enhancement of forest systems in the Mill Creek basin will also aid in the recruitment of woody debris for the basin's streams and result in more diverse habitat for birds and mammals (i.e. raptor perches, cavity nesters, etc.).

5. Restore Aquatic Vegetation - This action involves replacing aquatic vegetation removed through disturbance, changes in stream flows, and competition. To be effective, there may be some changes in the water body hydrology to encourage the re-establishment of this habitat component. Extensive introduction of aquatic plants to Mill Creek/Mullen Slough, for example, could have a localized, beneficial effect on dissolved oxygen concentrations. The use of typical monocots found in the Puget Sound lowland streams, such as Potamogeton sp. and Lemna sp. would require more research prior to implementation, since the success and effectiveness of this action is relatively unknown.

6. Control exotics - This action involves methods targeted to remove or suppress non-native plant species (e.g. blackberries, reed canarygrass, scot's broom). Removal of exotics from tributaries is already considered via shading through riparian vegetation plantings. Suppression techniques include controlled grazing, tilling, covering plants with black plastic, controlled burns, and flooding (separate from water control structure method). Chemical approaches are discouraged but could be part of a multi-control method plan. Disturbance should be minimized to discourage the regeneration of these invasive species. A brief description of control methods is found in Restoring Wetlands in Washington (WDE, 1993), and "Managing Problem Vegetation" (Ducks Unlimited, 1995).

### **3.4.2 Structural Habitat Diversification**

7. Add interspersions - Land-Water - This action involves increasing shoreline length and wetland diversity by increasing the interface between water and land. Existing open water areas would be enhanced to add a mosaic of other wetland types (**Figure 3-5**). Where water bodies would be created, irregular shorelines would be emphasized to maximize habitat value (**Figure 3-5**). Islands would have a similar effect.

8. Add interspersions - Land-Land - This action involves increasing diversity of wetland habitat by creating a mosaic of cover types. Meadows and emergent areas could be created within a forested area. Open areas would provide feeding and breeding areas for waterfowl as well as buffered feeding areas for herons. Some areas would have to be elevated to assure survival of target species, and in certain cases actually be upland habitat. This mixing of habitat types would increase diversity in wetland areas by providing other needed habitats for species dependent upon more than one wetland type. In certain cases it might not be appropriate to maximize on site interspersions so as to aid species which are dependent upon large contiguous tracts of particular cover types (e.g. yellow-billed cuckoo).

9. Wetland Buffer Improvement - This action involves creating or enhancing a wetland or upland woody buffer (minimum of 50 feet around wetlands outside the Mill Creek corridor (25 feet in places where existing land use prevent a larger buffer)). Plants in the buffer should all be native. In certain cases, the use of a berm between 2 to 6 feet high and 20 feet wide might be appropriate to keep runoff from entering a wetland. Creating an upland buffer should not occur at the expense of existing wetlands by placing fill into the wetland to establish a buffer.

10. Habitat Structures - This action involves installing wildlife habitat structures such as raptor perching poles, artificial snags, brush piles, culverts under roads to enhance small mammal and amphibian passage, and nest boxes in wetland and nearby upland areas. The use and management of snags for wildlife is described in the pamphlet "Managing Small Woodlands for Cavity Nesting Birds" (Pederson, 1991).

### **3.4.3 Topographic Alterations**

11. Excavate Ponds - This action involves excavating ponds primarily for waterfowl breeding habitat. These ponds should be groundwater fed and excavated to the appropriate depth. Some basic information on creation of ponds for waterfowl is found in "Management of Spring and Summer Brood Water Wetlands in the Central Valley" (Ducks Unlimited, 1995). The ponds should be designed to minimize fish stranding. In most cases they would be located as far as possible from water courses. Ponds could also be created to enhance great blue heron and amphibian habitat. Guidelines for creation of amphibian habitat is found in

"Criteria for the Restoration and Creation of Wetland Habitats for Lentic-Breeding Amphibians of the Puget Sound Basin" (Richter, 1996). The creation or improvement of existing ponds would increase the interspersed between water and land. As with Option 7, irregular shorelines should be used to maximize habitat value (**Figure 3-6**). Islands in ponds will increase breeding habitat for waterfowl.

12. Fish Habitat Structures - This action involves using primarily large woody debris (LWD) to create refuge areas and rearing pools for fish, and to divert channel flow as needed. LWD includes anchored logs and root wads, preferably long-lasting Western Red Cedar. Other structures designed specifically to increase fish habitat (such as lunkers or constructed covers over undercut banks), should not be ruled out in certain situations for use as instream structures. A key to successful placement of structures is to first examine the dynamics of the subject watercourse, and design placement of materials which match the stream conditions and desired habitats. Crispin (1988) presents an excellent discussion of the placement of LWD for fish habitat. In addition, excavation of the channel could be used in selected areas and cases to remove reed canarygrass, and/or create a low flow channel. This type of action is not encouraged and care must be taken not to remove any established riparian vegetation at the expense of removing or controlling exotics. Other modifications of watercourses are described below in Channel Reconfiguration (No. 13), and Floodplain Enhancement (No. 14).

13. Channel Reconfiguration (including reconnecting channel to floodplain) - This action involves either moving the channel back to its original meandering configuration, or creating a new channel that increases sinuosity. In selected cases the stream banks would also be regraded and replanted with native vegetation, and/or the substrate modified (refer to No. 14). Generally, it would not be wise to place cobbles or gravels in a stream unless there is a natural source to replenish these substrates and/or the flowing water has enough energy to prevent prolonged deposition of finer material on top of the coarser material.

14. Floodplain Enhancement - This action involves excavating an area approximately 50 to 100 feet wide on each side of an existing watercourse channel to create a "floodplain." This action would provide additional flood storage and reconnect wetlands to the watercourses. The Mill Creek Water Quality Management Plan (1993) contains a schematic of a two-stage channel for reconfigured stream sections. The two-stage channel concept is illustrated in **Figure 3-7**.

15. Construct Side Channels - This action involves constructing dendritic side channels down to the existing channel grade to provide off-channel fish habitat (**Figure 3-8**).

The dendrites would be pointed upstream, vary in length from about 20-100 feet and sloped to allow unimpeded drainage and reduce the possibility of fish stranding.

16. Remove Fill - This action involves removing fill to improve access to groundwater. The amount of fill removal would be dictated by existing conditions. Fill removal would also increase flood storage. This action would typically be included as part of a restoration action such as No. 2 listed above.

#### **3.4.4 Hydrologic Alterations**

17. Check Dams - This action involves installing check dams in ravines to reduce erosion potential. Periodic maintenance would be required. This action applies only to a few wetlands located in ravines on the hillside, and may be appropriate to other ravines in the basin which do not contain wetlands.

18. Water Control Structures - This action involves constructing water control structures to pond water. These structures would mainly be passive, employing berms with notched weirs without gates. In selected cases, gate structures would be considered. The primary purpose of this action would be to enhance emergent areas for water birds and shorebirds. The Soil Conservation Service Engineering Field Handbook, Chapter 13, Wetland Restoration, Enhancement, or Creation (1992), the U.S. Fish and Wildlife Service Waterfowl Management Handbook, Section 13.2.1, 'Waterfowl Use of Wetland Complexes' (1988), "Enhancing Agricultural Fields for Waterfowl" (Ducks Unlimited, 1995), and "Management of Spring and Summer Brood Water Wetlands in the Central Valley" (Ducks Unlimited, 1995) describe methods of constructing and operating water control structures. Manipulation of water levels to aid rails and other water birds is described in "Conservation of North American Rallids" (Eddleman and others, 1988).

Water control structures could function in conjunction with floodwater storage facilities. However, these structures should only be utilized in areas where fish use is not present. There may be specific circumstances where fish-friendly structures may be employed, however, the use of such structures when fish are present must be approved and coordinated with the SAMP Technical Oversight Committee. In most cases the use of active water control structures in areas where fish use is present is not recommended because of the possibility of stranding. One exception would be wetland 5K where an existing berm at the south end of the Emerald Downs mitigation site must be retained to regulate water flow through the system. This berm does not have an outlet structure and no outlet structure is proposed for this area. In addition, the change in hydrology should not adversely impact fish habitat in other areas of the waterway where fish may be present. The use of water control structures may not be an appropriate option at all for

providing hydrology to wetlands. In some cases, water control structures may, in fact, potentially "rob" a stream's hydrology to feed a wetland. Detailed site-specific baseline data on hydrology would be required to accurately ascertain the applicability of this option.

### **3.4.5 Fish Passage Improvements**

19. Culvert Modification - This action involves modification of culverts to improve fish passage on tributaries where culverts either present hydraulic jumps preventing fish passage, or constrictions slowing the passage of fish upstream or downstream. One source of details on culvert modification is Fish Habitat Enhancement A Manual for Freshwater, Estuarine and Marine Habitats (Adams, and Whyte, 1990).

20. Flap gate Modification - This action only applies to the flap gate at the mouth of Auburn Creek (Wetland 4B). This flap gate would be changed to a slide gate to allow for continuous fish passage except during high flow events on the Green River.

### **3.4.6 Public Access**

21. Access Restrictions - In areas where there is active human disturbance either from unauthorized recreation use or from agricultural activities (except livestock) access can be eliminated through the use of fencing and signage to minimize disturbance to the systems. Fencing options are discussed in Fish Habitat Enhancement A Manual for Freshwater, Estuarine and Marine Habitats (Adams, and Whyte, 1990).

### **3.4.7 Agricultural Best Management Practices**

22. Livestock Control (including fencing) - This action involves removing livestock from wetland areas, either permanently or on a seasonal rotational basis. Fencing of all water courses is required where seasonal grazing is allowed. "Livestock Grazing for Wetland and Waterfowl Management" (Ducks Unlimited, 1995), briefly describes rotational procedures which can be used to minimize impacts of grazing and improve habitat. Efforts should be made to develop rotational grazing schemes that would release pastures from continuous grazing between October 1 and April 30 to allow livestock and waterfowl to coexist. Implementation of King County Ordinance KCC21A.24 for livestock activities would also aid in utilizing appropriate BMP's.

### **3.4.8 Agricultural Lands Enhancement**

Ducks Unlimited (1995) has produced a series of pamphlets outlining procedures for making farmland more accessible for wildlife. This information should be accessed in designing any restoration efforts which involve actively farmed land.

23. Riparian Area Fencing and Enhancement - In areas where watercourses run through agricultural lands, significant restoration can be obtained through the enhancement of riparian areas by planting native vegetation, and using fences to control livestock access to those areas.

24. Grain Planting for Wintering Waterfowl - Planting of grain crops would enhance winter habitat for waterfowl by providing a stable food source. The "Barley for Birds" program is one possible mechanism which can be used in this action.

25. Flooding of Fields in Non-Planting Seasons for Wintering and Migrating Waterfowl and Shorebirds - The publication "Enhancing Agricultural Fields for Waterfowl" (Ducks Unlimited, 1995) contains information on timing and depth of flooding to enhance waterfowl habitat. In the Mill Creek basin, this technique would be used in the wintertime to enhance migratory and wintering waterfowl habitat, but not during the growing season.

26. Plugging of Existing Drainage Ditches - This would allow and facilitate sheet flow of areas that have been drained and ditched to restore hydrology and potentially increase native wetland vegetation re-establishment and/or recruitment. This option could also be utilized to control exotics such as reed canarygrass by flooding or inundation for a prolonged period of time. If the water in the existing drainage ditches is untreated and contains contaminants such as heavy metals from stormwater runoff then a forebay or settlement basin would need to be included to pre-treat the hydrology prior to sheet-flow hydrological restoration. Water quality monitoring would be required as part of the baseline data needed for site specific design.

27. Removal of Existing Drainage Tiles - This may be possible on many sites and could potentially restore hydrology to these sites. A history of the farm and where the drain tiles were placed would be required.

More detailed information on data and monitoring needs for restoration options are outlined in Chapter 5 of this report.

## 4. SITE SPECIFIC RESTORATION RECOMMENDATIONS

### 4.1 INTRODUCTION

The purpose of this chapter is to present specific restoration recommendations for individual wetlands, uplands and stream reaches in the Mill Creek Basin. The narratives are organized according to stream reaches along with their associated wetlands and uplands. This organization helps to order the restoration areas into potential corridors and habitat patches. The reader can then see where adjoining restoration opportunities exist. Many of the wetlands were mapped separately, but in fact function at least partially as a part of a system in association with other wetlands and streams. **The wetland number for wetlands which are part of a system are preceded by the letter "S"**. Throughout this chapter, the term "narrative summary" refers to observations made during site visits in the 1991 field season. The term "large woody debris" (LWD) refers to the use of large coniferous logs with attached rootwads to increase stream channel complexity and enhance fish habitat.

The restoration areas are separated into five subbasins: Mill Creek, Mullen Slough, Midway Creek, Auburn Creek, and the Green River. Each watercourse is divided into reaches, and associated wetlands and uplands are identified for the reach. For Mill Creek, descriptions of tributaries are added after the description of the particular reach which the tributary feeds into, or in the cases of Mullen Slough, Midway Creek, and Auburn Creeks, at the end of the description of the creek.

Each reach description contains a section describing existing conditions followed by stream restoration recommendations, and if applicable, wetland restoration recommendations. For wetlands which are not an integral part of the stream reach, the wetland description is given separately at the end of the reach description. For areas at the upper ends of watercourses, the reach description is abbreviated and the evaluation focuses on individual wetlands and wetland restoration recommendations. **Table 2-2** summarizes information concerning existing stream conditions, and the relationship of stream reaches to adjacent wetlands and restorable uplands. The stream reach descriptions starting in **paragraph 4.2** below describe existing conditions focusing on channel morphology, fish usage, existing cover, and water quality. Stream restoration recommendations for the channels and buffers are also included. **Table 3-4** summarizes recommended restoration actions for wetlands and restorable uplands



## **4.2 MIDWAY CREEK (WRIA 09.0043) AND ITS TRIBUTARIES**

### **Lower Midway Creek, RM 0.0-0.32**

**Stream Conditions:** This reach receives incidental surface runoff from the Midway Landfill and access roadways situated upslope to the west. In the 1960's the stream was relocated eastward during construction of a containment berm and leachate aeration pond near RM 0.1. Following treatment in this pond, leachate is tightlined to the King County sewage treatment plant at Renton. The stream banks within the lower portion of this reach are slumping into the creek. The streambed contains excessive volumes of fine sediments, and heavy algae growth indicates a potential for high nutrient loading in this reach. The riparian vegetation--with overhanging shrubs canopy-producing trees--is sparse and conifers are largely absent. In spite of these impacts, City of Seattle staff have found juvenile salmonids in this reach.

**Stream Restoration Recommendations:** The potential for restoring the existing channel within this reach is limited due to intermittent groundwater and/or surface water contamination and the narrowness of the potential riparian corridor. Where possible, trees (including conifers) and shrubs should be planted along the banks. Alternatively, the lower channel segment could be relocated to the south to a new discharge point further upstream on the Green River and away from the leachate pond area. This would allow restoration of instream habitat and revegetation of broad vegetated riparian corridor.

### **Middle Midway Creek, RM 0.32-0.60**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
1A	42.2	Yes	No	2	37	Low

**Stream Conditions:** Fish habitat in this reach ranges from fair to good due to densely vegetated groundwater-fed salmonid rearing areas in Wetland 1A, which flanks the main channel along the right bank. The segment from RM 0.49 to 0.58 flows in a braided channel through an alluvial fan at the base of the valley wall. A culvert blockage at RM 0.57 under SR-516 may block upstream fish passage.

**Stream Restoration Recommendations:** Replace culverts with an oversized arch pipe and stabilize SR-516 road fill with vegetation.

**Wetland Conditions:** Wetland 1A is a complex system of three emergent, two scrub-shrub, three forested, and three emergent/scrub-shrub communities. It is relatively free of exotic species, with moderate-aged (up to about 40 years) trees, and high interspersion values. The buffers surrounding this system are narrow and of low value. This system currently provides flood storage, but has been ditched and partially filled. Water quality is impacted by clearing and filling related to the Kent-Highlands landfill upslope, as well as runoff from SR-516 immediately upslope. Due to its size, complexity, interspersion, flood-storage capability, and habitat values, the WDE rating for this wetland is category II, 37 points.

**Wetland Restoration Recommendations:** None. The proximity of this site to the Kent Highlands Landfill limits the potential for restoration; preservation is the best alternative for this site.

### **Upper Midway Creek, RM 0.60-0.85**

**Stream Conditions:** This moderate to steep gradient reach flows through a ravine in the west valley wall. It has fair to good spawning gravels, but is subject to erosion due to undetained urban runoff from catchments upstream. It is presently inaccessible to salmonids under most flow conditions due to the geometry of the SR-516 culvert and lack of channel definition across an alluvial fan immediately downstream from the culvert outfall. In spite of these impacts, juvenile coho have been found upstream from this road crossing.

**Stream Restoration Recommendations:** Stabilize and restore ravine sideslopes. Modify the SR-516 culvert outfall to improve fish passage.

### **Tributary 0043A, RM 0.00-0.10**

**Stream Conditions:** This reach has been tightlined under the Midway Landfill, which is operated by the City of Seattle. Seepage from a filled ravine that used to flow directly into the creek is now collected and piped to the King County Renton STP trunkline. However, some residual leachate may still find its way into the creek.

Stream Restoration Recommendations: None. The former habitat in this reach is unrecoverable because of displacement of the ravine and streambed by the landfill and the STP leachate tightline. Collect and route surface runoff into the landfill leachate pond and convey treated leachate to the STP at Renton.

#### **Tributary 0043B, RM 0.00-0.14**

Stream Conditions: This stream has been converted to a ditch that drains the lower end of the landfill.

Stream Restoration Recommendations: None. This stream unrestorable due to potential contamination by surface water runoff and leachate from the landfill.

#### **Tributary 0043C, RM 0.00-0.22**

Stream Conditions: This mostly culverted stream receives runoff from SR-516 and upslope areas along S. Military Road. As a result, water quality is poor.

Stream Restoration Recommendations: The restoration potential is low due to water quality problems and an impassable culvert that is part of the SR-516 drainage system from the S. Military Road area. However, water quality in lower Midway Creek could be improved by tightlining this drainage to the landfill leachate aeration pond and routing treated leachate to the King County STP at Renton.

### **4.3 GREEN RIVER**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
1L	1.5	Yes	No	3	11	Low

Wetland Conditions: This wetland consists of an open water pond within the golf course. It is partially fringed by emergent vegetation (dominated by Typha) and is entirely surrounded by lawn.

Wetland Restoration Recommendations: None. The restoration potential is nil due to its location, and lack of an inlet and outlet (water is artificially piped in).

### **Tributary 0044AA, Kent Fishing Pond**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
1M	0.6	Yes	No	3	9	Low

**Stream and Wetland Conditions:** This short perennial tributary originates from groundwater seepage from the base of the west valley wall. It has been impounded to form a fishing pond within a public park south of S. Meeker Street. A flap gate at the mouth prevents salmonid ingress and egress to the river. Except for excess nutrients and fecal coliform from waterfowl feces, water quality appears to be good. The open water wetland was created from a wooded swamp. A few remnant cottonwoods remain scattered around the shoreline. There is only a small area of aquatic bed and little buffer value, as the wetland is bordered on three sides by roads. However, many ducks use the pond, particularly in late winter, when they appear to be forming pairs.

**Stream Restoration Recommendations:** At a minimum, revegetate a riparian corridor upstream from and alongside the pond. If conversion of the fishing pond to chinook and coho over-winter rearing habitat is deemed desirable, the flap gate could be removed and replaced by LWD to provide a series of fish-passable step-pools.

**Wetland Restoration Recommendations:** Revegetate part of the pond shoreline, and add LWD to the pond to provide cover for salmonids.

### **Tributary 0044BB, Apartments R/D Pond**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
1P	0.3	No	No	3	4	Low

**Stream Conditions:** This short perennial tributary originates from groundwater seepage from the base of the west valley wall and has been impounded to provide an R/D pond for an apartment complex. The discharge point to the river has not been identified.

**Wetland Conditions:** The wetland is an open water, concrete-lined pool used for landscaping for an apartment complex. The "buffer" consists of 50% patio and 50% lawn. This "wetland" appears to be entirely artificial with no significant habitat or flood storage values.

**Stream and Wetland Restoration Recommendations:** None. This site has been irreversibly altered to provide urban stormwater detention.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
1N	0.6	Yes	No	3	11	Low

**Wetland Conditions:** At present this wetland is essentially a ditch that directs water from Wetland 1O to the Green River. It is dominated by weedy emergent vegetation (mostly reed canarygrass and thistle) and lacks standing water. It is severely degraded due to clearing, ditching, and filling.

**Wetland Restoration Recommendations:** None. Because of its small size and location adjacent to a freeway, it is not cost-effective to restore this wetland.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
1O	0.2	No	No	2	21	Low

**Wetland Conditions:** This system is an open water pond with a forested (alder) fringe, and a sparse shrub understory. A portion of the shoreline along the freeway is rip-rapped. The interspersions are relatively low, and the buffer is poor (up to 80% of the wetland is bordered by an apartment parking lot and the freeway). The pond functions as a stormwater detention facility and is also fed by a perennial spring. Wildlife use seems low; a single pair of ring-necked ducks and an American coot were the only species observed on three different visits.

**Wetland Restoration Recommendations:** None.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2G	16.1	No	Partial	3	19	Low

**Wetland Conditions:** This system consists of two emergent and one forested segments. The forested area is less than an acre and consists primarily of cottonwoods. The forest has been

disturbed by grazing and human activity, leaving little understory and only a few older trees. The emergent wetlands are row crops and pasture, although (based on aerial photography and site visits) the crop land appears not to have been used since 1989. The system is isolated from streams, and has a drainage ditch along two sides.

Wetland Restoration Recommendations: None. The restoration potential is limited due to inadequate water supply.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2F	8.6	No	No	3	14	Low

Wetland Conditions: This system consists of two emergent zones, and one emergent/scrub-shrub area. It appears to contain old fill, as the ground is higher than the surrounding land. Ditches help to drain it. The vegetation consists largely of reed canarygrass and other exotics. The habitats are isolated, with no interspersions. The entire system is surrounded by parking lots, roads, and buildings.

Wetland Restoration Recommendations: None. To restore this site, considerable fill would have to be removed. Given the surrounding land uses and relatively small size of this system, there is little justification for restoring this wetland.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2QQ	3.4	No	No	3	14	Low

Wetland Conditions: This filled emergent wetland consists of about 50% reed canarygrass, 40% bentgrass, and 10% evergreen blackberry. The fill slopes down toward the west, apparently to encourage drainage into a ditch on the west edge of the site. Although dominated by exotics, the lush vegetation supports numerous meadow mice (*Microtus* sp.) and thatching ants. The surrounding land uses consist of buildings, parking lots, and roads, although the north edge is upland grassland.

Wetland Restoration Recommendations: None. Considerable fill would have to be removed to restore this site.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
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4E	4.1	Yes	No	3	19	Low
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**Wetland Conditions:** This system is a series of two open water/scrub-shrub habitats, with a patchy distribution of small cottonwoods and willows, an aquatic bed at one end, and a few scattered clumps of bulrushes and cattails. Water appears to enter the wetland from the north through culverts, which may also convey storm water. An outlet drains into forested Wetland 4EE adjacent to the Green River (see next discussion). The ponds have been greatly modified through clearing, dredging, and filling. They are within a mobile home park, so interspersed values are low (although the northern edge of one of the ponds is adjacent to a small woodland). Wildlife values are modest, although on one visit a great blue heron, northern shoveler, several mallards, hooded mergansers, and common mergansers were all actively feeding in the ponds. The presence of the heron and mergansers suggest that small fish and frogs (tadpoles) are present in the ponds.

**Wetland Restoration Recommendations:** None. This wetland's restoration potential is limited due to the surrounding land use.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
4EE	7.7	Yes	No			Low

**Wetland Conditions:** This system was not originally mapped as a wetland, but was "discovered" by SAMP team members while searching for detention pond sites. This is a forested wetland dominated by cottonwoods, a few of which may be greater than 50 years old. Many trees are young, so the average age is 30 to 40 years. The scrub-shrub understory is diverse, and includes salmonberry, elderberry, currant, red-osier dogwood, and other species. Although quite wet in the winter, the area appears to dry up in the summer. Although the Green River is adjacent to it, the wetland appears to be hydrologically disconnected from the river by levees.

**Wetland Restoration Recommendations:** Preserve.

#### 4.4 MULLEN SLOUGH (WRIA 09.0045) AND ITS TRIBUTARIES

##### Mouth Mullen Slough, RM 0.00-0.05

**Stream Conditions:** The channel lies above the current low flow Green River water surface elevation as an artifact of the old valley floor. As a result, the gradient is rather steep. The streambed under the Frager Road bridge is filled with riprap rubble, which can impede fish passage under some flow conditions. The banks are lined with reed canarygrass and blackberries, and the channel generally lacks overhanging or canopy cover. Water quality problems manifest in the summer as sudsy water and dense algal mats visible at the mouth and at various locations upstream. In spite of these impacts, juvenile and adult salmonids pass through this reach.

**Stream Restoration Recommendations:** Remove the riprap, add woody debris to form fish-passable step-pool habitat, and plant trees and shrubs along the banks.

#### **Lower Mullen Slough, RM 0.05-0.34**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2A	302	Yes	Yes	2	37	

Wetland Information: See below.

**Stream Conditions:** This reach has a fairly flat gradient and flows through the north end of Wetland S-2A. The streambed substrate consists mainly of sand and silt; LWD is absent. A relict confluence of a former wall base tributary is present at RM 0.32. The riparian corridor is of moderately good quality but is restricted by adjacent agricultural land uses (a nursery and row crops). The riparian vegetation consists of dense shrubs and an immature alder canopy. Low dissolved oxygen (DO) levels and high stream temperatures occur during late summer, and dense algal mats are especially visible at this time of year. High turbidity results from inputs of manure from upstream areas. Anecdotal evidence indicates that fish stranding might occur during floods when the adjacent fields are flooded.

**Stream Restoration Recommendations:** Add LWD to diversify instream habitat. If the site can be acquired from the King County Farmland Protection Program (FPP), plant the banks with shrubs and trees including conifers in order to increase the width of the riparian corridor.

#### **Lower Mullen Slough, RM 0.34-1.00, Associated Wetland S-2A**



**Stream Conditions:** This reach flows through Wetland S-2A. A farm road flanks much of the left bank, but a fairly broad mature deciduous forest is present along the right bank. This reach follows the historic meander pattern of the stream; some deeper pools and natural dendritic backwater channels are present. Many old cottonwoods remain on the shoreline of Mullen Slough. Manure stored in the Smith Bros. Dairy lagoon is sprayed onto saturated row crop fields from late February through June. Runoff from barns, loafing sheds, corrals near West Valley Highway and S. 277th Street enters the stream. Cows have direct access to the stream. In spite of these impacts, fish habitat utilization is high throughout this reach, based on MIT surveys.

**Stream Restoration Recommendations:** Review and update the Smith Brothers Dairy farm management plan to ensure that BMPs adequately control agricultural runoff (e.g., replace manure spraying with composting). Recontour the left bank to create a two-stage channel with floodplain, and add LWD to diversify the instream and wetland habitat. If the site can be acquired from the FPP, underplant the banks with shrubs and trees including conifers in order to increase the width of the riparian corridor, especially along the left bank. Alternatively, this reach could be relocated along the valley wall to improve water quality and allow restoration of fish habitat.

**Wetland Conditions:** Wetland S-2A is a large system consisting of two forested, 13 emergent, one scrub-shrub, one open water, three forested/scrub-shrub, one forested/emergent, and one open water/emergent area. Mill Creek forms this system's eastern border. The northwest section of this large wetland may have the highest quality forested wetland in the valley portion of the SAMP area. Despite the mix of habitat types, the interspersions are relatively low due to the location of the forests along one edge, and the large proportion of the emergent areas. The 13 emergent wetlands are virtually contiguous during the winter; they are mapped separately because of varying agricultural practices. This wetland supports small numbers of waterfowl in the winter, primarily Canada geese.

**Wetland Restoration Recommendations:** Enhance for waterfowl by excluding livestock during winter season under a cooperative agreement with the landowner. Expand and enhance riparian areas using native shrub and tree plantings, including conifers. If the property could be removed from the Farmland Preservation Program (FPP), an expansion of the forested wetland acreage could be achieved. However, consideration must be given to balancing increases in forested habitat versus maintaining existing waterfowl habitat.

**Tributaries 0045A (RM 0.00-0.17) and 0045B (0.00-0.18),** Associated Wetland S-2A (see above):

**Stream Conditions:** These streams, which enter Mullen Slough at RM 0.72 and 1.00, respectively, appear to be two arms of an old oxbow situated within Wetland S-2A. During flood conditions they are connected by a swale. Up to 3,000 acres of the valley floor undergo extensive, near-annual flooding mainly due to backwater flooding from the Green River mainstem into Mullen Slough, and thence into the Mill Creek floodplain, including the area near these oxbow tributaries. During such events, fish are subject to stranding throughout the floodplain in depressional areas within agricultural fields.

**Stream Restoration Recommendations:** Excavate these tributaries as off-channel dendrites for juvenile salmonid rearing and flood refuge habitat. Add LWD to provide fish cover and establish riparian plantings along both banks. To manage flooding and further reduce fish stranding in this part of the valley floor, excavate an interconnected system of low flow dendrites and an overflow channel from Mill Creek to Mullen Slough in the vicinity of these oxbow tributaries. This would reduce the frequency of stream bank overtopping along lower Mill Creek and also restore wetland habitat.

**Lower Mullen Slough, RM 1.00-1.80,** Associated Wetlands S-2A (see above) and S-2D

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2D	174.4	Yes	Partial	2	38	High

**Stream Conditions:** The lower portion of this reach flows through the south end of Wetland S-2A (RM 1.0 to 1.3), and the upper portion flows through Wetland S-2D (RM 1.3-1.8). This reach has been straightened and repeatedly dredged as an agricultural drainage ditch and functions like a large pond. Several unnumbered side channels enter on the right bank at RM 1.30, 1.35, 1.45 and 1.50. Tributary 0046 enters on the left bank at RM 1.5. Several other farm ditches that enter the stream on the left bank at RM 1.7 drain predominantly grassy pastures that are occasionally tilled for corn silage. The channel lacks LWD and the stream banks are heavily encroached upon by agricultural access roads and frequent dredging. Riparian vegetation is largely absent and reed canarygrass lines both banks. The stream receives inputs of manure and other agricultural wastes. Summer water temperatures are high and dissolved oxygen levels are

low, especially upstream from the confluence of Tributary 0046. In spite of these impacts, there is an active beaver dam within this reach and high fish populations have been reported by MIT.

Stream Restoration Recommendations: This reach and the adjacent wetland have a high restoration potential, despite requirements of the King County Farmland Preservation Program (FPP) that the adjacent farmlands remain in active agricultural use. At a minimum, the agricultural runoff problems, and Mullen Slough ditch maintenance should be addressed through farm plans and BMPs (including removal of reed canarygrass). If the adjacent farms are removed from the FPP in the future, the stream could be recontoured to create a two stage meandering channel, and some or all of the channelized tributaries could be recontoured into off-channel dendrites to provide rearing and flood refuge habitat for fish. If these actions are taken, care should be taken to preserve existing high quality riparian habitat. LWD should be added to diversify instream habitat and a broad riparian corridor revegetated to shade the stream and reduce agricultural runoff.

Wetland Conditions: This system is a continuation of wetland system S-2A, and is divided from S-2A by a single lane dirt road, Tributary 0046A, and a drainage ditch. This system includes eight emergent, four scrub-shrub, and two forested habitats. Mullen Slough flows north/south through the center of this system, and occasionally overflows, contributing to surface water on this system, particularly near the southern edge. The dredging of much of Mullen Slough 1990 temporarily decreased flooding. When surface water is present, waterfowl and shorebirds congregate by the hundreds. The principal species are green-winged teal, northern shoveler, lesser yellowlegs, dunlin, least sandpiper, and common snipe. The area south of Tributary 0046A (RM 1.5-1.8) is not in the FPP. One of the emergent areas is a two to three acre cattail/sedge marsh with up to two feet of permanent standing water. The marsh expands and contracts according to rains and drought periods. The two forested areas consist primarily of mature cottonwoods. The forested areas resulted in a Category I rating under the WDE rating system.

Wetland Restoration Recommendations: Enhance for waterfowl by excluding livestock during the winter under a cooperative agreement with the landowner. Restore areas not in the farm program to forest conditions on the western side and emergent and the eastern side. If this wetland could be removed from the FPP, additional forested areas could be established. However, consideration must be given to balancing increases in forested habitat versus maintenance of existing waterfowl habitat.

### **Middle Mullen Slough, RM 1.80-2.46**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2E	198.5	Yes	Partial	3	20	High

**Stream Conditions:** This reach flows through Wetland S-2E. Clean water flowing into this reach from the wooded ravine immediately upstream is rapidly degraded by agricultural impacts. Most of this reach has been channelized through grazed pastures. The stream banks are heavily trampled, the streambed lacks LWD and agricultural wastes freely enter the stream. The riparian vegetation consists of reed canarygrass and sparse shrubs; canopy-producing trees are absent.

**Stream Restoration Recommendations:** At a minimum the riparian corridor should be revegetated, and LWD added to the tributaries. Fencing and/or rest rotation plans can be used to minimize livestock impacts. If this property could be removed from the FPP, at least one added dendrite could be excavated to provide off channel fish rearing and flood refuge habitat and LWD added to diversify instream habitat. Install fencing to exclude livestock, and revegetate a riparian corridor along the dendrite(s) as well.

**Wetland Conditions:** This system is a continuation of the Mullen Slough systems to the north, but is separated from system S-2D by 277th Street, a four lane road. A series of drainage ditches (Mullen Slough, 0045; and tributaries 0047 and 0048) drain the wetland into Mullen Slough through a single culvert under 277th Street. The system consists of four rather undiverse emergent areas bordered by roads on three sides. The northern portion is permanently wet up to eight acres, providing very good habitat for waterfowl and shorebirds; a hunting club regularly utilizes the land for waterfowl hunting. Numerous raptors also use the area. Sharp-shinned, Cooper's, and red-tailed hawks are regularly seen, and an American kestrel was observed during the summer of 1991. The common waterfowl here are American widgeon (often numbering into the hundreds), green-winged teal, gadwall, and northern shoveler. Dunlin utilize the area during winter, along with lesser yellowlegs, dowitchers, western sandpipers, and least sandpipers during migration.

A 1.7 acre wetland, adjacent to Wetland S-2E, that did not get mapped in original delineation was discovered while performing a functional assessment. This wetland is a mature alder forest with permanently saturated soil. A drainage ditch is present but the wetland remains quite wet. The alders are roughly 40 years old, and the shrub understory is dominated by salmonberry. The wetland is at the base of a forested slope, but is bordered on two sides by roads and by farmland.

Wetland Restoration Recommendations: Enhance for waterfowl by excluding livestock during the winter under a cooperative agreement with the landowner. Forested areas should be re-established in portions of the wetland not in the FPP. If the property can be removed from the FPP, additional forested areas could be re-established. However, consideration must be given to balancing increases in forested habitat versus maintenance of existing waterfowl habitat.

#### **Upper Mullen Slough, RM 2.46-2.85**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
3A	14.7	No	No	2	33	Low

Stream Conditions: The lower end of this reach has been channelized along a driveway serving a residence that occupies the former alluvial fan at the mouth of the ravine. Log and concrete cribbing has been installed along the right bank near the residence to resist erosion and channel migration. The stream channel is dredged occasionally to remove sediments that accumulate in this location.

Stream Restoration Recommendations: Revegetate the riparian corridor and add LWD to the stream. If possible, reconfigure the channel in the lower segment of this reach to expand the quality and quantity of usable fish habitat.

Wetland Conditions: Wetland S-3A consists of one open water, two emergent, one emergent/scrub-shrub, and one scrub-shrub/forested habitats. The system is fairly complex, with good interspersions values. However, it is grazed and has suffered loss of understory vegetation. A developer who built an office building/equipment yard about six years ago reportedly changed a ditch location and changed the direction of flow in the ditch. This resulted in flooding of the wetland, which reportedly had never occurred prior to the developer's action. Upstream from here, the stream descends through a steep ravine incised in the valley wall. Water quality appears to be good; water temperatures are cool year around, and ample aeration is provided by passage

of water through riffles and plunge pools. This reach and the one above it (RM 2.58-2.80) contain the only salmonid spawning habitat in mainstem Mullen Slough. Anadromous fish passage is blocked above RM 2.85 due to impassable culverts and steep gradient.

Wetland Restoration Recommendations: None. The potential for restoration of this wetland is limited due to the proximity of roads, homes, and other structures to the wetland.

**Upper Mullen Slough, RM 2.85-3.2** Associated Wetlands S-SAMP37 (RM 3.05-3.1), SAMP36 (above RM 3.2)

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP 37	8.0	No	No	1	28	Low
SAMP 36	5.7	No	No	2	27	Low

Wetland Conditions:

Wetland S-SAMP37: This system contains open water, emergent, forested, and two scrub/shrub habitats. It is located about 800 feet east and downslope of SAMP36. The pond appears to be a livestock watering facility. It is artificially maintained through the use of pumps and pipes leading from the forested area, through which a perennial stream flows. The emergent areas are grazed pasture. Residential construction is encroaching on the forested and scrub/shrub habitats, causing an increase in erosion and sedimentation. The fact that this system is in a ravine, near the head of a subbasin has implications for water quality issues downstream in Mullen Slough.

Wetland Restoration Recommendations: Preserve and protect from erosion.

Wetland S-SAMP36: This system consists of forested, scrub/shrub, and emergent habitats surrounded by low-density residential housing. The center of forest understory is composed of a very dense, virtually impenetrable, stand of shrubs. The emergent area is a grazed pasture separated from the forest by a road, but connected by a culvert. The forest dries out in the summer, but water-stained leaves and trees indicate that standing water occurs regularly. This system is situated in a depression, and carries out important erosion and sedimentation control functions. It also has high wildlife habitat value.

Wetland Restoration Recommendations: Preserve.

**Star Lake Tributary (0046), RM 0.00-0.23, Associated Wetland S-2D (see above):**

**Stream Conditions:** This perennial stream segment has been channelized along the margins of an agricultural field to the north and through Wetland S-2D to the south, which is dominated by scrub-shrub species. The channel is trapezoidal and four to six feet deep. The stream receives clean, cool, spring-fed groundwater flow from Wetland S-2D to the south. The stream also receives occasional overflows from Lake Fenwick via a constructed drainage system and a vestigial natural stream channel (Tributary 0046A).

**Stream Restoration Recommendations:** Excavate dendrites and add LWD to provide structurally diverse off-channel year around rearing and flood refuge habitat. Expand and improve the vegetated riparian corridor along the left bank by underplanting with conifers in the wetlands and agricultural fields. If restoration of these agricultural lands is not possible, consider relocating the stream west along the base of the valley wall to reduce agricultural runoff impacts and protect water quality in and downstream from this reach.

**Star Lake Tributary (0046), RM 0.23-0.53; Associated Wetland S-2D (see above):**

**Stream Conditions:** This stream segment appears to have been channelized along the base of the west valley wall within Wetland 2D. The streambed is composed of suitably-sized, relatively clean spawning gravels, but due to previous channelization and lack of a source of large, coniferous LWD, the habitat consists almost entirely of riffles with a few shallow pools. Coho salmon and cutthroat trout spawn in this reach, making it one of the very few remaining productive patches of spawning habitat in the SAMP area. The surrounding deciduous forest provides good canopy cover in the summer, but shrubs are occasionally removed along the stream banks by local residents.

**Stream Restoration Recommendations:** Remove several acres of fill from the wetland north of S. 277th Street and restore a broad riparian corridor. Discontinue riparian clearing, underplant the adjacent riparian forest with conifers and add LWD to diversify instream habitat.

**Star Lake Tributary, RM 0.53-1.00; Associated Wetland 2PP (RM 5.3-6.0)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2PP	0.5	No	No	2	33	Medium

**Stream Conditions:** This reach passes through a constructed pond (Wetland 2PR, a.k.a. "Star Pond") west of an historic mansion situated on a terrace flanking the west valley wall. The mansion is now used as a church. The pond receives some runoff from S. 272nd Way, and it also appears to receive sediment-laden flows from developed areas upstream from S. 272nd Way.

**Stream Restoration Recommendations:** Stabilize roadcuts along S. 272nd Way to reduce erosion, and implement highway BMPs to treat road runoff. Add waterlogged LWD to the pond and revegetate denuded areas along the pond margin to enhance fish and wildlife habitat. Modify the pond outlet to provide fish passage and reduce risk of mass wasting of the driveway fill during heavy storms.

**Wetland Conditions:** Wetland 2PP is an open water pond surrounded by forest. Originally a cedar swamp, the pond was dredged as a log-storage area for a sawmill. The pond has minimal components of emergent, scrub-shrub, and forested wetlands along its shore. Gadwall, mallard, and American coot were observed on the pond.

The pond discharges to the valley floor through a culvert under a driveway that is suspended approximately six feet above the surface elevation of the downstream channel. The culvert under S. 277th Street at RM 0.7 tends to accumulate large volumes of sediment; this could pose a fish passage barrier under some flow conditions.

**Wetland Restoration Recommendations:** Add plantings around the pond to widen the buffer.

### **Star Lake, RM 1.00-1.65**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
KCLG14	33.8	No	No	3	13	Low

**Wetland Conditions:** The shoreline of this lake is totally surrounded by residences with lawns and a few bulkheads along the edge of the lake. There is no wetland vegetation, with the exception of two small areas at the west end of the lake, where a few bulrushes and cattails survive.



Wetland Restoration Recommendations: Contact the lake shore residents to see if any of them is interested in converting a portion of their lawn to riparian vegetation. Revegetate the lake outlet channel with native trees and shrubs.

**Lake Fenwick, Tributary 0046A, RM 0.00-1.05,** Associated Wetlands King County Lower Green River 6 (RM 0.36-0.77), S-SAMP43 (RM 0.9-1.0); SAMP42 (above RM 1.05;)

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
KCLG6	18.9	No	No	2	38	Low
SAMP43	2.5	No	No	1	39	Low
SAMP42	3.7	No	No	1	25	Low

Stream Conditions: This is a large constructed drainage system, not a stream. It is inaccessible to salmonids due to gradient limitations, seasonally dry segments with subsurface flow, and extensive culverting and bank armoring. Springs in the ravine walls with an orange flocculent material and possibly low dissolved oxygen seep into this reach. In spite of these conditions, numerous cutthroat have been found at the Fenwick Road S. culvert outfall (RM 0.08).

Stream Restoration Recommendations: None, due to the steepness of the gradient and irreversible habitat fragmentation.

Wetland Conditions: Lower Green River Wetland 6 (KCLG6)(Lake Fenwick): The shoreline is mostly forested except for the southern end, which is developed for residential use. Most of the lake is a City of Kent park, with a good trail system, and picnic, swimming and fishing areas. Up to three acres on the west shore is a complex of pond and shrub habitats that support nesting waterfowl and amphibians. The lake contains milfoil and generally lacks snags, logs, and aquatic beds. Nonetheless, the system is surprisingly diverse and in good condition, despite heavy use by people, especially in the summer months.

Wetland Restoration Recommendations: Continue efforts to improve water quality. Add LWD along the west side of lake.

**Wetland Conditions: Wetland S-SAMP 43:** This system contains forested, scrub-shrub and openwater habitats. It drains southeasterly into Lake Fenwick, and lies within a City of Kent park. The wetland is at the base of a steep hill, that has a large residential development at the top, resulting in runoff into the wetland. In addition, a busy road and parking lot that encircle the wetland discharge stormwater runoff into it. The soils are compacted in places. However, the forested portion contains some large trees and snags, and the open water pond has emergent marsh and aquatic beds, so habitats are fairly diverse. Cooper's hawk, red-tailed hawk, pileated woodpecker, ruby-crowned kinglet, black-capped and chestnut-backed chickadee, mallard, and gadwall have been observed using the site.

**Wetland Restoration Recommendations:** Consider the possibility of restricting access to and re-vegetating the most sensitive portions of the site.

**Wetland Conditions: Wetland SAMP 42:** This system contains forested and scrub/shrub habitat dominated by young alders and salmonberry. The ground was covered by fresh fine sand, obviously the result of recent flooding. An obvious channel meanders through the wetland, however, no outlet could be found. This may explain why so much sediment had been deposited in this wetland. Residences and a large church and playground border the wetland. Past filling has occurred in portions of the wetland.

**Wetland Restoration Recommendations:** Preserve.

**Tributary 0047, RM 0.00-0.57, Associated Wetland 2E (see above):**

**Stream Conditions:** This seasonal stream has been channelized through agricultural fields in Wetland 2E. Dairy wastes enter the stream, the banks are trampled by livestock, and the riparian vegetation consists of a narrow strip of mainly reed canarygrass.

**Stream Restoration Recommendations:** At a minimum vegetate the riparian corridor and add LWD to the tributaries. Implement farm plans to minimize livestock impacts. If these properties can be removed from the FPP, excavate at least one dendrite to provide off channel fish rearing and flood refuge habitat, and add LWD to diversify instream habitat. Revegetate a riparian corridor along the dendrite(s) as well.

**Tributary 0047, RM 0.57-0.75, Associated Wetland 2FFF (RM 6.7-7.5)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2FFF	0.9	No	No	2	24	High

**Stream Conditions:** The lower portion of this reach has potential salmonid spawning habitat impacted by ravine clearing and residential development upstream.

**Stream Restoration Recommendations:** Enforce clearing restrictions on steep slopes to reduce erosion and sedimentation.

**Wetland Conditions:** Wetland 2FFF is an emergent/scrub-shrub system adjacent to Wetland 2E. It lies at the base of a forested steep slope and is bordered by farmlands to the east. Although it drains into 2E, it has been mapped as a separate wetland because of its slightly higher elevation and lack of interaction with 2E. The vegetation includes willow, buttercup, cattail, and small-fruited bulrush. Standing water is seldom, if ever, present, but the soil appears to be permanently saturated.

**Wetland Restoration Recommendations:** Block the drainage ditch to increase depth and duration of inundation.

**Tributary 0047, RM 0.75-1.05, Associated Wetland SAMP 38 (above RM 1.05)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP38	1.4	No	No	2	23	Low

**Wetland Conditions:** This topographically diverse forested wetland has been selectively logged, with the timber left on the ground. The remaining trees are quite immature, and there is very little understory vegetation. Water enters the wetland from an adjacent pasture. Additionally, grazing by horses occurs in the wetland. New residential construction was occurring nearby. This system provides floodflow alteration, sediment stabilization, sediment retention, and nutrient removal but these functions are limited because the wetland is at the head of its watershed.

**Wetland Restoration Recommendations:** Preserve. Much of the wetland is on high ground, so the source of hydrology is unknown, apparently the result of a high water table. Restoration

potential is therefore somewhat difficult to assess. Given the uncertainty, the potential for restoration is low.

**Tributary 0048, RM 0.00-0.60, Associated Wetland S-2E (see above):**

**Stream Conditions:** This seasonal stream has similar conditions to those of Tributary 0047 in Wetland 2E, except it is bordered by row crops. Sediment accumulates in this reach from ditching upstream at Boscolo Farm.

**Stream Restoration Recommendations:** At a minimum the revegetate the riparian corridor and add LWD. If the property can be removed from the FPP, excavate at least one dendrite to provide off channel fish rearing and flood refuge habitat and add additional LWD to diversify instream habitat. Revegetate a riparian corridor along the dendrite(s) as well.

**Tributary 0048, RM 0.60-1.00**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP40	1.3	No	No	2	23	Medium

**Stream Conditions:** This reach descends through a steep ravine with localized slope failures initiated by vegetation clearing and undetained overland flow from upstream development.

**Stream Restoration Recommendations:** Enforce clearing restrictions on steep slopes to reduce erosion and sedimentation.

**Wetland Conditions:** Wetland SAMP 40: This forested wetland lies at the base of west valley wall; it has no apparent inlet. A road upslope from this wetland appears to be a source of runoff into this system. The outlet flows into a ditch that flows along pastures and then into Mullen Slough. Trash has been dumped into the wetland from the road. The wetland is dominated by alders and salmonberry, and the soil is mucky, though no water was present during a December field visit. This swamp has relatively mature (50 to 80 year old) trees, relatively good structural diversity, and lacks exotic species. Though the structural diversity is high, species diversity is low, and its connectivity to other habitats is also low.

Wetland Restoration Recommendations: Preserve. This wetland is in relatively good condition, although it contains some trash that should be removed.

**Tributary 0049, RM 0.00-0.33:**

Stream Conditions: This manmade trapezoidal ditch diverts flow from a previous drainage course within Bingaman Creek canyon that formerly flowed across the valley floor floodplain and thence into mainstem Mullen Slough within the Boscolo farm. The current configuration necessitates frequent dredging of alluvial fan sediments that accumulate in the ditch. From RM 0.30-0.33 the left bank abuts the road shoulder and a constructed berm flanks the right bank. The streambed substrate is sand and gravel from a former gravel mine upstream that is now a subdivision; no LWD is present. A few trees between the road and the stream provide some shade in the summer. Fish passage at RM 0.06 may be obstructed during certain flow conditions due to sedimentation of an undersized culvert under S. 277th Street. The culvert under 56th Avenue S. at RM 0.33 blocks anadromous salmonid passage due to a four foot drop from the outlet to the elevation of the streambed below; cutthroat trout occupy the reach upstream from this road crossing.

Stream Restoration Recommendations: Replace S. 277th Street culvert with an oversized arch pipe to improve fish passage and sediment transport. Install a fish ladder below the 56th Avenue S. culvert to restore fish passage. Reestablish the alluvial fan and relocate the stream along a natural gradient downslope to the valley floor floodplain. Add LWD and plant riparian trees and shrubs.

**Tributary 0049, RM 0.33-1.2, Associated Wetland SAMP 41 (RM 0.33-0.38)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP41	1.3	No	No	2	35	High

Stream Conditions: A tightlined drainage system from an abandoned gravel pit near Star Lake Road has separated on a steep slope above the left bank of the stream at RM 0.45. Flows have eroded into a landslide hazard area and initiated slope failures that are a major source of sediment that severely impacts downstream fish and wetland habitat.

Stream Restoration Recommendations: At a minimum, stabilize and restore the abandoned gravel pit, including the drainage system. Consider converting The gravel pit into an R/D pond to detain peak stormflows, trap sediment, improve water quality and protect downstream fish habitat. Alternatively, route peak stormflows into a new storm drainage trunkline down Star Lake Road to the valley floor. The buffer on the outlet stream from Bingamon Pond can be enhanced and expanded where possible.

Wetland Conditions: This forested wetland is more diverse in terms of species than wetland SAMP 41, because of the presence of older, larger trees, and a permanent stream.

Wetland Restoration Recommendations: Preserve.

**Tributary 0049, RM 1.2-1.35, (Bingamon Pond)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
KCLG15	14.4	No	No	1	46	Low

Wetland Conditions: This system consists of a diverse array of open water, emergent, and scrub-shrub habitats. The pond has peat soils and was once actively mined for peat. Portions of the south and east shoreline were cleared in the early 1990's for home construction. A bulkhead and driveway were constructed along the east shore in late 1991. An owner at the east end of Bingamon Pond stated that in the past the pond was much smaller, and was more than 90 feet from his driveway. He feels that a neighbor caused the pond to expand when he built a dam at the pond's outlet in the late 1980's. The north and west shoreline is still heavily forested; the few houses along this side of the pond are set back one hundred feet or more, and do not impact the forest. Part of this area is in the King County Open Space Program. This and the great blue heron pond in Peasley Canyon are the last remaining forested/open water habitats in the SAMP area that still contain a high proportion of good wildlife habitat. However, aerial photographs from 1940 show the pond surrounded by saplings, indicating that the forest is barely 50 years of age. The pond contains many dead snags and fallen logs, which may indicate that the water was raised in recent years. The pond currently provides excellent habitat for a variety of wildlife. Wood duck, green-winged teal, northern shoveler, mallard, American coot, great blue heron, and Virginia rail have all been observed on the pond during the nesting season. Evidence of beaver use is also apparent. On the negative side, one local resident complained that frogs used to be

plentiful, but that he hasn't seen or heard frogs in recent years. The wetland also has high heritage and recreation values.

Wetland Restoration Recommendations: Preserve. Although this wetland is in excellent condition, it may be useful to investigate the water quality. A forest buffer should be acquired to protect the pond.

**Tributary 0049, RM 1.35-1.95**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
KCLG50	10.8	No	No	1	38	Low

Wetland Conditions: This rather "stringy" system is composed of the same five habitat classes as Mill Creek Wetland (KCMC) 18. A perennial stream runs through this system, first flowing south from the intersection of Star Lake Road and Military Road, and then turning northeast toward Bingamon Pond (Lower Green River Wetland 15). Part of the system is in the King County Open Space Program. The system is highly variable in habitat quality; it ranges from nearly pristine in some areas to highly degraded in others. Dirt roads provide access for off-road vehicles, and much trash has been dumped in the wetland. Parts of the wetland, however, are nearly inaccessible due to dense brush. A trail parallels the stream for nearly the entire length. Despite the disturbance to this system, it is rated category 1 based on mature trees and lack of exotic species.

Wetland Restoration Recommendations: Preserve, remove trash, block ORV access and revegetate cleared areas.

**Tributary 0049, RM 1.95-2.8**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP35	4.6	No	No	3	21	Low
SAMP35A	0.6	No	No	0	4	Low
SAMP34	0.2	No	No	3	15	Low
SAMP32A	0.5	No	No	0	4	Low
SAMP32	0.9	No	No	3	14	Low
SAMP33	13.9	No	No	2	27	Low
SAMP31	1.2	No	No	3	16	Low

**Stream Conditions:** This stream segment flows through several residential areas and varies in instream habitat quality. The buffer is of varying width and quality.

**Stream Restoration Recommendations :** Enhance and expand the buffer where possible for water quality improvement and expansion of migration corridors.

**Wetland Conditions: Wetland SAMP35:** This system consists of scrub-shrub, emergent, and open water habitats. The scrub-shrub area is 99% spirea, and the emergent area is a narrow strip of exotic weeds on fill which borders the spirea. The open water pond is tiny and contains a few cattails; it was excavated to provide stormwater detention for an adjacent mobile home park. High density residential housing surrounds the system. The area is in a low-lying depression and has peat soils.

**Wetland Restoration Recommendations:** None, due to adjacent land uses and conversion of this system into an R/D pond.

**Wetland Conditions: Wetland SAMP35-A:** This emergent wetland lies within a ball field, which is located on private property. Access was not possible, so evaluation was conducted from the street. Detailed evaluation of plant species was not possible, nor was a search for inlets and outlets to the wetland. The wetland has been seeded to lawn grasses and is regularly mowed.

**Wetland Restoration Recommendations:** None.

**Wetland Conditions: Wetland S-SAMP34:** This tiny system contains a square open water pond and an emergent area. The pond is an artifact of a gravel mining operation. The emergent area has developed on a low-lying portion of the excavated borrow area, and consists mostly of exotic weeds.

**Wetland Restoration Recommendations:** None. Due to the wetland's isolated location and small size.

**Wetland Conditions: Wetland S-SAMP32:** This small system contains emergent and scrub-shrub habitats. The emergent area is 99% reed canarygrass, and the scrub-shrub area is 95% spirea. Although choked with spirea, the scrub-shrub area held some mallards as observed



during a site visit in October 1991. The emergent area is on a slope, and appears to support occasional grazing. The pre-eminent function that this wetland provides is sediment stabilization.

Wetland Restoration Recommendations: None.

Wetland Conditions: Wetland SAMP32-A: Although mapped as a scrub-shrub wetland, this system is in fact about 50% spirea and 50% reed canarygrass. It is adjacent to SAMP32. A storm sewer from an adjacent mobile home park empties into this wetland, which is located along a tributary which flows east from SAMP33 into SAMP35.

Wetland Restoration Recommendations: The restoration potential of this system is rather low, but an attempt could be made to control the reed canarygrass, the spirea, and water levels, in order to restore native wetland vegetation.

Wetland Conditions: Wetland S-SAMP33: This system consists of a scrub-shrub area dominated by hawthorn and spires, surrounded by a fringe of swamp consisting Western red cedar, Sitka spruce, and red alder. The hawthorns are 20 to 30 feet in height and produce abundant berries that provide food for birds such as cedar waxwings. Water in the wetland appears to be permanent. The area is surrounded by residential development, but the forest fringe provides a good buffer for the shrub-scrub wetland.

Wetland Restoration Recommendations: Preserve. In addition, consider thinning the spirea. AN outlet control structure could be installed, but careful hydrologic and hydraulic analysis would be needed to ensure that the trees are not killed by changes in depth and frequency of inundation.

Wetland Conditions: Wetland S-SAMP31: This small system consists of an open water pond and emergent habitats located in the midst of a residential neighborhood. The pond's sides appear to be built up, suggesting that it may be man-made or at least modified by man. The emergent area provides good cover for ducks. However, there is little adjacent habitat, and the pond's value to wildlife is low. This wetland also provides a modest amount of sediment retention, nutrient removal, and floodflow alteration.

Wetland Restoration Recommendations: None, due to the developed nature of the surrounding area.

**Tributaries 0045, 0047, 0048, and 0049;** Associated Wetland 2E (see above); Special Restoration Option:

Stream Conditions: The valley floor segments of these streams were historically tributaries that flowed across wetlands on alluvial fans. During conversion of the valley floor to agricultural land uses they were channelized along with Mullen Slough to form agricultural drainage ditches within Wetland 2E.

Stream Restoration Recommendations: Consider routing the combined flows from two or more of these tributaries into a new channel along the west valley wall to improve fish habitat quality and quantity. One or more portions of the new channel could be widened into a pond and/or dendrites. Fence the stream(s), and replant broad riparian buffer to reduce agricultural impacts and improve fish and wildlife habitat. Tributary 0053 could also be added to this combination of tributaries.

#### **4.5 MILL CREEK (WRIA 09.0051) AND ITS TRIBUTARIES**

**Mill Creek, RM 0.00 - 0.20 (Mouth);** Associated Upland MC1 (see below):

Stream Conditions: This reach flows through associated Upland MC1. Past channelization (channel is deeply incised between 10 to 15 feet), lack of LWD, levee construction and the steep gradient from the upper end of the reach to the mainstem Green River pose passage problems for fish moving from the mainstem into Mill Creek, especially during late summer/early fall low flow conditions. This reach is also deficient in native riparian vegetation; instead, the bank vegetation consists mostly of reed canarygrass and blackberries. Coho, chinook and cutthroat have been found in this reach.

Stream Restoration Recommendations: Add LWD (logs with rootwads) to form a more natural stair-step configuration with resting pools to improve cover and fish passage during low flows and provide flood refuge during higher flows. Revegetate the banks with native shrubs and trees.

**Mill Creek, RM 0.20- 0.30 (SR-181 Crossing);** Associated Upland MC1:

**Stream Conditions:** This reach also flows through Upland MC1, and is more structurally diverse and steeper than any other segment of Mill Creek except the reach within Peasley Canyon (RM 6.2-6.8). The streambed is composed mostly of gravel and cobble. Although some pools are present, they lack adequate cover other than concrete rubble on the bottom. Large woody debris (LWD) volumes are high compared to most other reaches of Mill Creek. The left bank is generally well vegetated, but the right bank is covered mostly with blackberries. The right bank under the SR 181 bridge at the upstream end of this reach is eroding due to human foot traffic, and riprap from the bridge abutments has fallen into the water. Very high densities of coho have been found here from June through September, along with chinook and steelhead salmon and cutthroat and rainbow trout.

**Stream Restoration Recommendations:** Construct two or three "dendrites" (blind back channels) along the left bank through the trees, and add LWD to increase salmonid rearing and flood refuge habitat. Remove the blackberries along the right bank and establish native trees and shrubs, including conifers. In the event that the bridge abutments need repair, replace the riprap with bank bio-stabilization elements, including larger toe rock and "live geo-grids" (alternating layers of willow and dogwood cuttings and geotextile-wrapped soil).

### **Mill Creek, RM 0.30-0.50**

**Stream Conditions:** This reach of Mill Creek and much of the valley floor upstream is subject to extensive near annual flooding, primarily due to backwater from the Green River. Flood flows mingle with those of Mullen Slough, leading to fish stranding in agricultural fields. Flooding closes West Valley Highway between S. 262nd Street and S. 277th Street. Both banks are covered with very dense blackberries. Very high densities of coho are present June through September along with chinook and cutthroat.

**Stream Restoration Recommendations:** Remove blackberries and establish native shrubs and trees, including conifers on both banks. The width of this buffer will depend on whether the adjacent properties can be removed from the FPP.

### **Mill Creek, RM 0.50-0.90, Associated Wetland S-2B (see below):**

**Stream Conditions:** This flat valley floor reach is moderately sinuous and borders Wetland 2B on its right bank. The stream bed is composed mainly of silt, and lacks LWD. The corridor of

riparian vegetation is narrow but moderately dense, with localized canopy cover and pervasive blackberry and reed canarygrass infestation.

Stream Restoration Recommendations: Control exotic vegetation and widen the riparian vegetative corridor with native tree and shrub plantings. If the adjacent properties can be removed from the FPP, excavate a two-stage channel to reconnect the stream with its floodplain. Also consider constructing one or more dendrites to increase off-channel coho over-wintering and flood refuge habitat.

**Mill Creek, RM 0.90-1.50** (Smith Bros.), Associated Wetlands S-2A (RM 0.9-1.08), see Mullen Slough narrative above; S-2D (RM 1.08-1.50), see Mullen Slough Narrative above.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2B	74.7	Yes	Yes	3	17	

Stream Conditions: This sand/silt-bottomed, flat, valley floor reach, which flows alongside of Wetlands S-2B (right bank), and S-2A and S-2D (left bank) has the original meander form, but has been routinely dredged in the past as part of ongoing agricultural operations along both banks. The banks are denuded and farm roads and raised berms flank portions of both banks, encroaching into the floodplain. Segments of the berms were installed under a WDE consent order to prevent direct drainage of manure into the stream. The existing narrow swath of riparian vegetation is composed mainly of blackberries and reed canarygrass. In spite of the consent order, the stream receives inputs of agricultural chemicals from poor tillage practices, runoff from farm ditches, and manure spraying. Dissolved oxygen is moderately low (5 mg/dl) in the summer and early fall. Adult fish stranding occurs during winter storms.

Stream Restoration Recommendations: Replace the berm along the left bank with raised containment around Smith Bros. Dairy. Review and update the Smith Bros. Dairy farm management plan to ensure that BMPs adequately control agricultural runoff (e.g., replace manure spraying with composting). Plant native trees and shrubs to restore the riparian corridor. Add LWD to the channel. If the adjacent property can be removed from the FPP, remove the right bank berm and excavate two-stage channel to reconnect the stream with its floodplain. Excavate the channel near RM 1.0 and create a high flow connection to Mullen Slough in order to decrease stranding of adult fish during floods. Solution of the latter problem also requires management of backwater flooding from the Green River.

**Wetland Conditions:** Wetland S-2B is a system of two emergent habitats, one is a pasture, the other is row crop farmland. This system is connected to Wetland S-2C by a culvert running under West Valley Highway. An undersized culvert that drains into Mill Creek at the north end of wetland causes water to pond in the area during heavy rain episodes when floodflows overtop the banks of Mill Creek. When flooded, this wetland attracts a number of waterfowl, primarily green-winged teal, northern pintails, northern shovelers, American widgeons, and American coots. During a site visit in March 1991 over 100 green-winged teal were present. Through most of the year--and during some winters--the wetland has no water and is of little value to wildlife. Though bordered on the east by West Valley Highway, the wetland has a good buffer to the north and west.

**Wetland Restoration Recommendations:** Enhance for waterfowl by excluding livestock during winter season and holding floodwaters in the area until April 20 under a cooperative agreement with the landowners. If desirable, modifications could be made that would flood the area sooner, and hold the water longer; however, this would require raising West Valley Highway to prevent road flooding; the cost for this may be prohibitive. If the property can be removed from the FPP, then an expansion of the forested wetland acreage could be achieved. However, consideration must be given to balancing increases in forested habitat with maintenance of waterfowl habitat.

**Mill Creek, RM 1.50-1.80** (Carpinito Farms); also floodplain uplands 2CN (16.9 acres) and 2CS (17.8 acres)

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2C	44.5	Yes	No	3	18	High

**Stream Conditions:** This flat valley floor reach, which flows through Wetland S-2C, has been channelized, but remains moderately sinuous. The streambed is composed of silt, sand and fine gravel, and lacks LWD. Riparian vegetation is almost nonexistent; tillage for row crops (corn and pumpkins) occurs almost up to the top of bank. Water quality is adversely affected by agricultural runoff (sediment and possibly agricultural chemicals). This reach is subject to high streamflow velocities during the initial phase of heavy storms (i.e., before this area receives backwater flows from the Green River). In spite of these impacts, this reach has exceptionally high salmonid densities.

**Stream Restoration Recommendations:** At a minimum, implement a farm management plan with BMPs that will reduce agricultural runoff. Purchase of all or part of the property would allow restoration of both the stream and some or all of site's former wetlands. Full restoration would include establishment of a vegetated riparian corridor, daylighting of a piped tributary to provide additional habitat for salmonids that currently use a remnant ditched segment of this tributary, and excavation of a two-stage channel and at least one dendrite to reconnect the stream to its former floodplain. Water quality impacts from the SR 167/S. 277th Street interchange (which currently overtops during floods) should be reduced by implementation of highway BMPs as part of a planned interchange upgrade.

**Wetland Conditions:** Wetland S-2C is composed of four emergent, two forested, and two emergent/scrub-shrub habitats. Mill Creek flows through the southern portion of this system. The wetlands are bordered by highways on two sides, a developed upland to the north, and a narrow upland area to the east between the wetland and SR 167. Bald eagles occasionally perched on a large cottonwood that was situated on the upland to the east of the wetland. This cottonwood was cleared as part of normal farming practices in 1994. The entire system was cleared and graded in 1990, except for one row of locust trees adjacent to the west valley highway.

**Wetland Restoration Recommendations:** Enhance for waterfowl, using emergent plantings. Restore riparian buffer along creek. Excavate up to one foot in depth within the northern upland parcel and revegetate to match the grade of the adjacent wetland. Plant a buffer of trees along SR 167. Plant vegetation on the southern upland parcel to restore a buffer along SR 167.

**Mill Creek, RM 1.80-2.30** (Schuller Bros.), also associated upland UP2XX (43.4 acres)

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2XX	20.4	Yes	No	3	20	High

**Stream Conditions:** Mill Creek has a natural meander configuration in this reach. In the downstream portion it flows through upland UP2XX. The upstream portion of this reach flows along the northeast edge of Wetland 2XX. The streambed is composed of sand and silt and is covered with extensive aquatic plant growth. The stream banks are denuded and heavily trampled by cattle. Water quality is adversely affected by feedlot runoff, which causes high BOD

and high concentrations of nitrogenous compounds. Heavy oil slicks and very murky water enter Mill Creek from right bank tributary 0051AA, which flows into the creek at RM 1.9.

Stream Restoration Recommendations: At a minimum, install fencing to exclude livestock and implement a farm management program with BMPs that will effectively control agricultural runoff and allow some riparian revegetation with native trees and shrubs. A more robust solution would entail site acquisition and conversion to a stream/wetland complex, including excavation of a two-stage channel with dendrites to restore the floodplain, addition of LWD, and riparian revegetation. Collect and treat urban runoff in Tributary 0051AA before releasing it into the stream.

Wetland Conditions: Heavy grazing occurs on both the upland and wetland. Wetland 2XX is an emergent pasture, with a component of open water during flood events. The wetland borders Mill Creek, but, due to effective dikes, Mill Creek does not flood onto this wetland. Rather, water appears to be a result of runoff from other sources. The pasture has been severely overgrazed, with a significant portion of it bare mud. In spite of extensive habitat degradation, this site supports a large waterfowl population during the winter. The wetland attracts a variety of waterfowl, including American widgeons, northern pintails, and mallards. The area is used as a hunting club, though it does not appear to be actively managed for waterfowl production.

Wetland Restoration Recommendations: Restoration should target specific management to improve waterfowl habitat. Keep mixed habitats, including potholes for ducks. Not much excavation is needed onsite, perhaps one foot throughout.

**Tributary 0053, RM 0.00-1.10**, also associated uplands UP2XX and 11-acre UP3C (RM 0.7-0.85); and associated wetlands 2XX (see above) and S-3C (RM 0.85-0.9)

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
3C	7.233.8	No	No	3	11	Low

Stream Conditions: This reach has been channelized in a ditch on the east side of West Valley Highway adjacent to UP2XX and Wetland 2XX. Water quality is poor due to road runoff, agricultural wastes and roadside vegetation management. Backwater flooding has been reported up to the S. 287th Street intersection with West Valley Highway. Fish use is high up to RM 0.2, where fish passage is blocked by a gabion wall. From RM 0.2 - 0.9 this channel functions as a

roadside ditch. It appears that most of the flow originating upstream from RM 0.9 sheet flows south through a dense scrub-shrub area in Wetland S-2G instead of under West Valley Highway at RM 0.9.

Stream Restoration Recommendations: This tributary could be relocated to flow through this system to Wetland 2XX and then Mill Creek. Alternately, relocate this reach west along the valley wall in combination with flows in Tributaries 0045, 0046, 0047, 0048 and 0049 to restore instream and riparian habitat and reduce agricultural and road runoff impacts.

Wetland Conditions: Wetland S-3C comprises two emergent areas within farmland. Upland UP3C is adjacent to this wetland, and has similar conditions but is at a higher elevation. The wetlands have standing water during heavy storms. The system has no visible inlet and has been ditched for agricultural purposes; nonetheless wetland plant species predominate over pasture grasses. This site appears to have been pasture at one time, but has not been grazed recently; it is currently used for hay production. Some spirea is present along a fence line. Canada geese, mallard, and common yellowthroat were observed during a site visit in April 1991.

Wetland Restoration Recommendations: None, due to questionable water supply and nearby commercial development.

**Tributary 0053, RM 1.10-1.35;** Associated Wetlands S-3B (RM 1.1-1.18; 4.9 acres; 100-Year Floodplain-No) and SAMP39 (RM 1.18-1.2; 8.0 acres; 100-Year Floodplain-No):

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
3B	4.9	No	No	2	33	Low
SAMP39	8.0	No	No	2	36	Medium
SAMP26	0.6	No	No	2	31	Low
SAMP26A	0.6	No	No	3	9	Low

Stream Conditions: This reach descends through the lower end of a wooded ravine within Wetlands 3B and SAMP39. The wetland and stream undergo chronic sedimentation from localized erosion and sloughing of the ravine walls below culvert outfalls and from vegetation clearing in and upstream from this reach. Riparian trees and shrubs are present in some areas, along with a small amount of LWD. In spite of these impacts, the streambed contains small pools and patches of gravel that could support cutthroat and coho spawners.



Stream Restoration Recommendations: The source(s) of sediment upstream should be investigated and, if possible, addressed prior to habitat restoration in this reach. Enhancement actions within this reach include riparian plantings and addition of LWD to the channel. Additional field work is needed to determine the extent to which salmonids already use this reach, and whether this stream already flows in whole or in part in a northerly direction into Wetland S-2E. Based on this information, the biological value of connecting this stream with some combination of tributaries 0045, 0047, and 0049 can be determined. Additional analysis is also needed of potential hydraulic impacts of combining and relocating some or all of these tributaries, which likely intermingled on the valley floor prior to channelization and agricultural development of this part of the valley floor.

Wetland Conditions: Wetland S-3B: This is a small system of one scrub-shrub and one forested habitats. The system has been overgrazed and the habitat is of poor quality. The trees are primarily medium-aged (about 40 year-old) cottonwoods, with no understory.

Wetland Conditions: Wetland SAMP39: This system is composed of one emergent area and one forested area at the base of the West Valley wall. The catchment area draining to this wetland is relatively large. Thus, the wetland provides significant stabilization and retention. The emergent area, as well as much of the forested wetland groundcover, however, is about 90% reed canarygrass and other exotic pasture grasses. In addition, the system is grazed by livestock. Despite the grazing impacts the forest structure is relatively diverse. Snags and fallen logs are present and the forest is well connected to other high quality habitats.

Wetland Restoration Recommendations: Fence off the forest to prevent continued grazing of the understory.

Wetland Conditions: Wetland SAMP26: This is a small emergent wetland in a transmission line right-of-way. Though small, this wetland contains several species of native sedges, rushes, and other marsh plants. Livestock grazing occurs adjacent to this wetland. A covey of California quail and a red-tailed hawk were observed near this wetland during a site visit in October 1991.

Wetland Restoration Recommendations: Install fencing to protect this wetland from grazing.

Wetland SAMP26A: This is a man-made open water pond used for production of exotic waterfowl, including flamingos. It is located in the back yard of a private residence in the midst of a residential tract.

Wetland Restoration Recommendations: None.

**Mill Creek, RM 2.30-2.50;** Associated Wetlands S-5A (RM 2.35-2.4) and S5-B (see below):

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5A	57.1	Yes	No	2	28	High

Stream Conditions: This moderate gradient reach consists of a mixture of pool, riffle and run habitat; the substrate composition varies from gravel to silt. Channel confinement between SR-167 and Frontage Road has resulted in disconnection of the stream from its floodplain and has limited the potential width of the vegetated riparian corridor. Where this stream exits from the culvert under SR 167 a fence collects debris and may be a partial fish passage barrier. The original stream channel enters the existing channel through a culvert under Frontage Road at approximately RM 2.35, connecting to wetland 5B. The banks are densely vegetated with reed canarygrass, but young alders provide a nascent canopy. DOT is proposing to revegetate this reach and construct bio-swales to treat highway runoff as mitigation for the addition of HOV lanes to SR-167.

Stream Restoration Recommendations: Restore the historic channel alignment and reconfigure the existing channel as a dendrite. Use of the old channel alignment depends on restoration actions in Wetland 5B. Alternatively, the historic channel could be reconfigured as one or more dendrites, with revegetation of a broad riparian corridor. Large woody debris could be added from an existing access at RM 2.35. Though the timing of the future planned upgrade of Frontage Road by the City of Auburn is uncertain, this project should include replacement of existing culverts by bridges to accommodate the restored alignment of the channel and dendrite(s).

Wetland Conditions: Wetland 5A is a system of four emergent, one scrub-shrub, and one emergent/scrub-shrub habitats. Flooding of the scrub-shrub portion of the system occurs annually, apparently through overflow of the drainage ditches. Waterfowl are usually present

when the wetland is inundated. The wetland is used by waterfowl, including mallard, pintail, and widgeon. In May 1991, two broods of mallards were seen in the scrub-shrub wetland.

Wetland Restoration Recommendations: Restore at least part of this system to a forested condition.

**Mill Creek, RM 2.50-2.85 (Fiorito)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5B	52.4	Yes	No	3	17	High

Stream Conditions: (This stream was being restored as this report was being printed) This reach has been extensively channelized within Wetland 5B and lacks LWD; nonetheless, the streambed consists of relatively clean gravels. Mill Creek flows along the western edge of the system, but a levee prevents any significant exchange of water. The habitat complexity is moderate due to the presence of backwater areas and alcoves. The bank vegetation consists almost entirely of reed canarygrass. The channel is choked with canarygrass and also contains tires and other metallic debris. Sporadic water quality problems manifesting as scummy, soapy foul-smelling water have been reported at the 37th Street NW culvert outfall; the source has not been identified. Dissolved oxygen is moderately low in the summer and early fall (5 mg/dl). In spite of these impacts, this reach supports large scale suckers and high salmonid overwintering fry densities.

Stream Restoration Recommendations: Implement a stream/floodplain restoration plan to where possible meander the channel and revegetate with riparian vegetation. Add LWD to creek. Investigate the possible point source(s) of pollution and collect and treat urban runoff before releasing it into the stream. In the north end of the parcel consider reconnecting the creek to the old channel and routing it into Wetland 5A.

Wetland Conditions: (About 14 acres, including both wetland and upland were being restored as this report was being printed) Wetland 5B is composed of three grazed emergent habitats. The vegetation consists of pasture grasses, buttercup, and a few sedges. Several bird species were observed in May 1991, including mallard, great blue heron, marsh wren, and common yellowthroat. An American kestrel, uncommon in King County, was also observed. The southern half of the site is being developed as the Northwest Auburn Industrial Park. Mitigation for the wetland fill will establish a gently meandering channel on the west end of the property

separated by a warehouse complex from a nine acre wetland mitigation area. The wetland will be connected to the creek only during high flows.

Wetland Restoration Recommendations: The size of this wetland and its adjacency to Mill Creek make it a good choice for restoration. Allow flows from Mill Creek, especially during storms to enter this wetland, and hold the water for as long as possible. Establish emergent vegetation as well as shrubs and trees.

### **Mill Creek, RM 2.85-3.50 (Puget Power Substation)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5E	60.0	Yes	No	2	25	High

Stream Conditions: Much of this reach was relocated near the west edge of Wetland 5E in the 1980's along an access road built during construction of the substation. As a result, part of the riparian corridor along the left bank is crowded along the road shoulder. A short segment of the historic channel now serves as a dendrite (Tributary 0051BB) that merges with the right bank of Mill Creek at approximately RM 2.90. A small amount of water is still present in part of the old channel through late spring. Although the main channel has a few small pools, and one large one at RM 2.88, nearly all of the rock habitat structures placed during the relocation are now buried in sediment and the channel is devoid of LWD. Excavation spoils were used to create a segmented berm approximately 6 feet high and mainly vegetated with grasses, along both banks. The berm has created a fairly good visual screen for Mill Creek wildlife. Riparian plantings (mostly willows and volunteer alders) have resulted in a small stand of shade-producing deciduous trees and shrubs near the south end of the site, but the north end generally lacks cover and much of the channel is choked with reed canarygrass. Runoff from 37th Street NW causes occasional water quality problems. Dissolved oxygen concentrations as low as 3.4 mg/L have been reported (R. Malcolm, pers. comm., 1995). In spite of these conditions, salmonid fry densities are high in this reach.

Stream Restoration Recommendations: Implement an improved stream/floodplain restoration plan in conjunction with Puget Power's proposed substation expansion. Alternatively, the site could be acquired and fully restored. Full restoration would include addition of LWD to the pool at the north end; reconfiguration of an additional segment of the old channel to serve as a dendrite, or relocation of the stream into the former channel and reconfiguration of the existing

channel as one or more dendrites; addition of LWD to the reconfigured channel and dendrite(s), and expansion and diversification of riparian vegetation.

**Wetland Conditions:** Wetland 5E is composed of three emergent areas and one open water pond with Mill Creek flowing along the western edge. The emergent areas that make up most of this system are old pastures that have not been grazed in recent years, and are vegetated with pasture grasses, reed canarygrass, and evergreen blackberry. The pond is a man-made, approximately 20-foot wide ditch which is used to collect water from the south end of the parcel and route it around the transformer pads. The pond is bordered by a narrow strip of immature alders and willows. Water quality appears to be poor. No wetland-dependent animals were observed at this site, except for a single hooded merganser in March 1992.

**Wetland Restoration Recommendations:** Plant trees to help reduce the reed canarygrass and restore forested conditions.

**Mill Creek Tributary 0051CC** (enters Mill Creek at RM 3.48); Associated Wetland 5E (see above):

**Stream Conditions:** The downstream end of this tributary has been channelized into roadside ditches at the south end of Wetland 5E, along the north side of 29th Street NW and the upstream end parallels the Burlington Northern railroad tracks. A weir at Mill Creek diverts this stream into the old Mill Creek channel, which is choked with reed canarygrass. Localized clumps of trees form a fragmented canopy, but development of mature riparian vegetation is precluded by vegetation management practices (mowing and herbicide application). Nonetheless, high densities of salmonid fry have been found here.

**Stream Restoration Recommendations:** Relocate this tributary approximately 0.1 mile north of the road shoulder, and install screened ditches to collect road runoff while excluding salmonids. Since the road is now closed at the railroad tracks, traffic will have decreased somewhat lessening the need for runoff collection. Add LWD to the restored channel(s) to provide diverse instream habitat, install fencing to exclude livestock, and plant native trees and shrubs to create a vegetated riparian corridor.

**Mill Creek Tributary 0051DD** (enters Mill Creek at RM 3.50); Associated Upland UP5G

**Stream Conditions:** This tributary flows in a roadside ditch along the south side of 29th Street NW. It lacks riparian vegetative cover and is subject to vegetation management and road runoff impacts .

**Stream Restoration Recommendations:** Although no salmonids have been found in this tributary, it could be restored to provide fish habitat by relocating it south of the road and reconfiguring it as a Mill Creek dendrite.

**Mill Creek, RM 3.50-3.70** (Neff); Associated Upland UP5G (24.7 acres)

**Stream Conditions:** This site contains upland pastures and various farm buildings and appurtenances. This reach has been channelized along the east and is subject to frequent overbank flooding. The channel is narrow, relatively deep, and lacks LWD. Riparian vegetation is absent except for reed canarygrass. Livestock have free access to the stream.

**Stream Restoration Recommendations:** At a minimum, update the farm management plan to ensure that BMPs effectively limit livestock access, minimize agricultural runoff, and revegetate a riparian corridor. Full restoration would entail site acquisition, excavation of a two-stage channel with meanders and at least one dendrite, and extensive riparian and upland revegetation.

**Mill Creek, RM 3.7-4.1** (Merlino)

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5G	43.6	Yes	No	3	17	High

**Stream Conditions:** This reach flows through Wetland 5G. This system is currently farmed for row crops except for the remnants of the old Mill Creek channel. There are six areas of emergent marsh in the system. The stream has been channelized and an access road flanks the left bank. The right bank is ploughed to the top of the bank. The existing channel is devoid of LWD and choked with reed canarygrass.

**Stream Restoration Recommendations:** Site acquisition would allow relocation of this reach into a more natural two-stage channel plus excavation of dendrites and reconnection of the stream to

its former floodplain. Relocation may be constrained by the presence of the sewer line along the left bank. LWD could be added to both the dendrites and the main channel, and the entire site could be revegetated as a stream/wetland complex.

**Wetland Conditions:** The old channel is a vegetated (cattail, soft rush, reed canarygrass) swale. The creek was regularly dredged and the material side cast into the wetland. Ponding occurs extensively to the east of Mill Creek, with several inches of water over several acres still present in May 1991. Mallard, gadwall, and common yellowthroat were all observed and presumed to be nesting at that time. However, plowing of the wetland areas (except the old channel) resumed in 1994 reducing the existing habitat value. Within the past decade, various commercial developments have been proposed for this site, but no permits have been issued.

**Wetland Restoration Recommendations:** Revegetate with shrubs and trees to reestablish forested conditions.

**Mill Creek, RM 4.1-4.5 (Calhoun), Associated Floodplain Upland UP5J (8.3 acres)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5J	35.0	Yes	No	3	15	High

**Stream Conditions:** This reach flows through an abandoned field in Wetland 5J, which is subject to frequent ponding during the winter. The reach then flows under Highway 167 into wetland 5G. The channel has been dredged and spoils deposited along the banks in some areas. The substrate consists of silt and the channel contains minimal LWD. The stream banks are heavily overgrown with blackberries and reed canarygrass, but a deciduous canopy has regenerated over portions of the site, providing partial canopy cover.

**Stream Restoration Recommendations:** Excavate dendrites to expand the existing connection between the cattail marsh and the channel, add LWD and revegetate a broad riparian corridor with native trees and shrubs. Reed canarygrass should be removed from Mill Creek to improve fish passage.

**Wetland Conditions:** The wetland contains two emergent areas and one open water pond. The emergent marsh to the south consists of cattails, bulrushes, and many other native wetland species. Although a few pockets of open water are present, they appear to be rapidly

disappearing due to encroachment by cattails. Reed canarygrass is dominant near Mill Creek as well as throughout the marsh in the northern part of this system. A brood of Canada geese was seen near the confluence of this stream with Mill Creek.

Wetland Restoration Recommendations: Cattails should be partially removed to provide more interspersed habitats. In addition, plant shrubs and trees to provide additional habitat diversity and buffer the site from surrounding land uses. Due to the wet nature of this parcel, restoration to a forested system would probably not work. Instead the system should be allowed to flood naturally and continue to evolve as an emergent system. Excavate upland UP5J to the grade of adjacent Wetland 5J and plant buffer vegetation.

**Mill Creek Tributary 0051F, RM 0.00-0.52**, also Associated Wetlands 5J (see above)

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5XX	0.3	No	No	3	16	High
SAMP24	1.5	No	No	3	12	Low
SAMP25	1.1	No	No	2	31	Low

**Stream Conditions:** This stream originates in a set of springs that provide part of the City of Auburn's water supply; the remainder of the spring water discharges into an old gravel pit near the base of the west valley wall. From there the water enters a culvert. At RM 0.15 the tributary daylighted along the margins of fill within Wetland 5J that supports an industrial park. Adjacent building activities have resulted in a fair amount of trash dumping in this stream (which also seems to be periodically cleaned out). Water quality (temperature and dissolved oxygen) in Mill Creek improves dramatically at the confluence of this stream with the mainstem at RM 4.22.

Stream Restoration Recommendations: This stream could be tightlined and conveyed under head pressure to a new discharge point further upstream on Mill Creek to expand its existing beneficial influence on water quality in the mainstem.

**Wetland Conditions:** Wetland 5XX is a scrub-shrub wetland at the base of a large forested slope. Its water sources include seepage and runoff from the slope. A small marshy area on top of fill extends to the south from this wetland for a distance of about 200 feet. The scrub-shrub wetland is primarily alder saplings and lesser amounts of young cottonwoods. A somewhat uncommon woodland grass (*Leersia* sp.) was found growing under these trees. The trees are all young,



indicating that the forest was cleared in recent years. The wetland is adjacent to an industrial development. A clear stream flows from the hillside only a few feet from this wetland. Two unidentified voles (*Microtus* sp) were found in the emergent part of the wetland and common yellowthroat and black-headed grosbeak were also sighted here.

Wetland Restoration Recommendations: Preserve. Although this wetland is small and provides only modest amounts of direct wildlife habitat, it is well connected to upland habitat on the adjacent wooded slope. Moreover, its position at the base of the hill makes it important in erosion control.

Wetland Conditions, Wetland SAMP24: This is a mature forest on a steep slope (located about one-half mile north of SAMP 15 and 16). This wetland is rated category 1 under the WDE rating due to the presence of mature (50- to 80-year old) trees, high structural diversity in the forest, and relative absence of exotic species. It also contains numerous dead snags, downed logs, at least three canopy layers, large surrounding buffers (in the form of upland forests), and connectivity to adjacent high quality habitats. Much of the surrounding forest is within the city of Auburn municipal watershed. The wetland is close to the top edge of the West Valley wall; large homes have been constructed up to the wetland edge. These homes are sources of sediment and pipes convey runoff from the street into the wetland.

Wetland Restoration Recommendations: Preserve and replant the slope between the wetland and the houses to prevent further sedimentation.

Wetland Conditions, Wetland SAMP25: This is a system very similar in character to SAMP24, except that it is on top of the hill, has taller trees and has a more open understory. It drains in the direction of the head end of tributary 0053.

Wetland Restoration Recommendations: Preserve.

**Mill Creek, RM 4.50-4.90** (Gertrude Jones), also Associated Upland 5KN (1 acre)

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5K	117.4	Yes	No	3	20	Low
5ZZ	3.7	No	No	3	16	Medium

**Stream Conditions:** This reach flows through the north end of Wetland S-5K, which was actively farmed until the late 1980's, with periodic dredging of the channel. The streambed is composed of sand and silt and is devoid of LWD. The upstream end of the site is somewhat dryer than the downstream end and is vegetated mainly by reed canarygrass. The downstream end contains a cattail marsh. The riparian zone lacks a canopy and contains only sparse shrubs.

**Stream Restoration Recommendations:** Excavate a low flow channel and dendrites and add LWD to provide a more defined summer low flow channel and overbank storage in the winter. Revegetate a broad riparian zone with native shrubs and trees.

**Wetland Conditions:** Wetland S-5K is a large system of three emergent, one open water/emergent, and one scrub-shrub/emergent habitats. The south end of the site contains large pockets of uplands surrounded by reed canarygrass. The primary water source appears to be the hillside to the west, and storm drains leading from the West Valley Highway into the wetland. An east-west berm at the north end of the site backs up undetermined volumes of water into the site during winter storms. Though dominated by reed canarygrass, pasture grasses, spirea, and evergreen blackberries, the wetland also has patches of native plant species including various sedges, cattails, and willows. Waterfowl have been observed during several site visits.

**Wetland Restoration Recommendations:** Restore sedge marshes, aquatic beds, emergent marshes on the north end of the site, which has very wet conditions. Plant native trees and shrubs to create a mosaic of forested riparian swamp and marsh habitats. Excavate the upland to the grade of adjacent Wetland 5K. Plant a buffer.

**Wetland Conditions:** Wetland 5ZZ: This is an emergent system which receives water from the adjacent hillside. Although it has been ditched to promote drainage, it also has been preserved as a mitigation/stormwater detention area. However, it is still quite wet, and shows evidence of having been forested at one time. It is still dominated by native species, including small-fruited bulrush, and sawbeak sedge (*Carex stipate*) However, soft rush, buttercup, and meadow foxtail are all present and may indicate that the wetland is becoming drier over time. Willow flycatcher is the only wetland-dependent bird species observed.

**Wetland Restoration Recommendations:** The topography of the wetland is rather varied, and restoration by blocking ditches and holding water could result in creation of a pothole-type

system. The addition of hard-stemmed bulrush, pondweed, knotweed, and certain woody plants such as Oregon ash and bitter cherry could make this a very diverse and productive wetland.

**Mill Creek, RM 4.9-5.2** (Emerald Downs Racetrack Mitigation Site) Associated Wetland S-5K (see above)

**Stream Conditions:** This flat, valley floor reach flows through the central portion of Wetland S-5K and has similar characteristics to the reaches immediately upstream and downstream. It is being restored under the Emerald Downs Racetrack mitigation plan to a mosaic of forested riparian swamp and marsh habitats.

**Stream Restoration Recommendations:** None. The mitigation plan should result in substantial restoration of this reach and the south half of Wetland S-5K.

**Wetland Restoration Recommendations:** None. The mitigation plan should result in substantial restoration of this reach including about 26 acres on the south half of Wetland S-5K.

**Mill Creek, RM 5.20-5.55** (North of Main Street), Associated Wetland S-5K (RM 4.5-5.55) (see above), also Associated Upland 5KN (6.7 acres)

**Stream Conditions:** The channel has been straightened and repeatedly dredged with deposition of dredge spoils along the banks. The old sinuous channel is still visible west of the current channel. The streambed consists mostly of sand and silt and is generally devoid of LWD, except near the upstream end where gravels, some LWD and overhanging vegetation are present. Blackberries and small trees are growing on the dredge spoils. Dissolved oxygen concentrations as low as 2.7 mg/dl have been reported (R. Malcolm, pers. comm., 1995). WDFW plants coho fry in and near this reach.

**Stream Restoration Recommendations:** Excavate a low flow channel and dendrites to restore meanders and a connection of the stream with its floodplain. Add LWD to the channel and revegetate a broad riparian area.

**Wetland Conditions:** Wetland S-5K is a large system of three emergent, one open water/emergent, and one scrub-shrub/emergent habitats. The south end of the site contains large pockets of uplands surrounded by reed canarygrass. The primary water source appears to be the

hillside to the west, and storm drains leading from the West Valley Highway into the wetland. An east-west berm at the north end of the site backs up undetermined volumes of water into the site during winter storms. Though dominated by reed canarygrass, pasture grasses, spirea, and evergreen blackberries, the wetland also has patches of native plant species including various sedges, cattails, and willows. Waterfowl have been observed during several site visits.

Wetland Restoration Recommendations: The potential exists to create a diverse system of wetland habitats that would serve a large number of wildlife species. Revegetate the site with native tree and shrub species similar to those planted at the Emerald Downs Racetrack mitigation site. The site's large size is conducive to flood storage. Dense emergent vegetation could be planted and maintained to slow floodflows across the site and improve flood storage retention on the site in conjunction with excavating a low flow channel, and dendrites, and adding LWD. The topography of this system is already quite varied, so pothole ponds could be readily created to provide habitat for amphibians, waterfowl, and herons. The feasibility of removing the berm could be explored, but it may be better to leave a portion of it in place to support conifer plantings and maintain the existing hydraulic controls.

On the upland, remove fill to the grade of adjacent Wetland S-5K and revegetate with forest species.

### **Mill Creek Tributary 0051GG**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP15	3.2	Yes	No	3	21	Low
SAMP 16	0.9	No	No	2	29	Low
KCMC6	2.7	No	No	2	28	Low

Wetland Conditions, SAMP 15: This forested wetland consists primarily alders under 40 years of age. The wetland is situated on the steep eastern slope of the plateau facing the valley. It serves as an effective trap for sediment, and helps prevent massive erosion and flooding of an arterial road down slope that connects the valley to the hillside communities. However, some slumping into the wetland is likely the result of recent clearing on the hilltop just above the wetland. The wetland also supports wildlife primarily mountain beaver and moles, which find the loose, wet soils on the slope ideal for burrowing.

Wetland Restoration Recommendations: Preserve. This wetland is in a very sensitive location and should be preserved to protect Mill Creek from excessive sedimentation. In order to protect this wetland the feasibility of correcting upslope drainage problems and revegetating upslope areas should be investigated.

Wetland Conditions, SAMP 16: This forested wetland is similar in character to SAMP15, but is on steeper slopes with more unstable soils. Fortunately, there has been no disturbance to the forests above the wetland, and erosion and slumping are still minimal. A small number of houses at the lower end of the wetland, as well as West Valley Highway, could be impacted by erosion and slumping of this hillside. As with the case with SAMP 15, mountain beavers and moles are numerous.

Wetland Restoration Recommendations: Preserve. The forests above the wetland must be kept intact, or serious erosion potential exists both above and below the wetland. This wetland should be preserved to protect Mill Creek from excessive sedimentation.

Wetland Conditions, KCMC6: This open water pond is in a relatively natural condition. Only one residence is near the shoreline; the remainder of the shore is relatively well vegetated with shrubs and trees, although a trail winds through the trees all around the pond. A small vegetated island is also present. The few small areas of cattails and bulrush scattered around the edge are probably insufficient to provide adequate cover for nesting waterfowl. Mallard, green-winged teal, American widgeon, and bufflehead were observed during a December 1991 site visit.

Wetland Restoration Recommendations: Preserve. Protect both the wetland and the surrounding upland buffers. It may be possible to restore additional marsh habitat by re-grading part of the shoreline to a more gentle slope and re-vegetating with emergent species.

**Tributary 0051E, RM 0.00-0.45 (Yahn):**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP12	7.1	No	No	0	4	Low
5YY	1.1	No	No	3	21	Medium

Stream Conditions: This tributary is piped under Yahn funeral home for most of its length.

Stream Restoration Recommendations: Reconfigure the open channel into a dendrite capable of intercepting clean groundwater to provide local water quality improvement in Mill Creek, flood storage and over-wintering salmonid habitat.

**Wetland Conditions:** This wetland is mostly forested with a small scrub-shrub area on the east end. It is located near the top of the west hill, and drains down the steep slope into the valley. The primary source of water appears to be runoff from the west. The terrain is relatively level with some hummocks and depressional areas. The vegetation consists of alders, cottonwoods, Oregon ash, Douglas fir, and, quaking aspen - a somewhat uncommon species in King County. The understory is well developed but not very diverse in terms of number of species. The forest is relatively structurally diverse, with several layers of trees and shrubs, as well as snags and fallen logs. The wetland is surrounded by forested uplands, though a few houses are nearby. A forest to the immediate east of the wetland was logged a few years ago and is now in a very early seral stage of recovery, with many young alders and Scot's broom. Part of this cleared forest appears to drain water from SAMP12. Thus, some flood attenuation function may have been lost with the clearing of this forest, and sedimentation and erosion may well have increased.

Wetland Restoration Recommendations: Preserve in order to maintain stormwater detention and water quality protection.

**Wetland Conditions, 5YY:** This wetland is primarily emergent, with a small scrub-shrub component. It is dominated by American bulrush (Scirpus americanus), Bolander's rush (Juncus bolanderi), and tapered rush (Juncus acuminatus). Alder saplings appear to be invading the wetland. The water source appears to be runoff from upslope areas. The surrounding area is a cottonwood/Oregon ash forest, and a cleared forest that is currently composed of Scot's broom and pioneering grasses. The wetland may have silted in somewhat since the forest was cleared, as there is evidence of erosion from the hillside. Thus, the wetland performs an erosion-control function. The wetland is somewhat protected by virtue of being in the bottom of a ravine; however, locals ride horses through the wetland.

Wetland Restoration Recommendations: Underplant with conifers to restore forested conditions in the cleared area.

**Mill Creek, RM 5.55-5.60** (Main Street Interchange):

Stream Conditions: This reach is culverted under the Main Street/SR 181/SR-18 interchange. The habitat here is unrecoverable.

Stream Restoration Recommendations: None.

**Mill Creek, RM 5.60-5.75** (Neely), Associated Wetland S-5P Upland UP5P (see below)

Stream Conditions: Much of the western half of this site has been incrementally filled and contains irregularly shaped remnant wetlands interspersed with filled uplands. The channel flows through Wetland 5P. The downstream end of this reach flows through an abandoned field that is currently dominated by reed canarygrass monoculture sprinkled with scattered clumps of willows and blackberry. The channel is excessively wide, exposed and almost completely devoid of LWD. The streambed is composed of sand and silt. Dissolved oxygen is low, and water temperatures and BOD are elevated in the summer. A residence within the floodway near the right bank that is subject to chronic flooding was recently purchased to allow habitat restoration.

Stream Restoration Recommendations: Excavate filled areas throughout the site to restore floodplain wetlands and water quality. Also, excavate a two-stage channel and a dendrite that would extend northwest toward the Alder Grove reach just upstream. Add LWD and revegetate the site with native trees and shrubs to restore a riparian corridor for habitat and water quality benefits.

**Mill Creek, RM 5.75-6.00** (Alder Grove), also Associated Floodplain Upland UP5P (16.4 acres)

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5P	11.2	Yes	No	2	28	High

Stream and Wetland Conditions: Much of the western half of this site has been incrementally filled and contains irregularly shaped remnant wetlands that function as vernal pools, interspersed with filled uplands. The wetland is a highly disturbed system composed of emergent, scrub-shrub/emergent, and forested/scrub-shrub areas. The stream was channelized into its current location within Wetland 5P along the west side of SR-167 in the early 1980's. At that time, dredge material was deposited along the banks of the creek in irregular mounds. The

upper end of this reach lies within the historic alluvial fan of Peasley Canyon and as such remains an active deposition zone for sediments that originate in the canyon and the steep tributaries that incise the west valley wall. As the channel gradient gradually flattens within this reach, the mean particle size decreases from cobble and coarse gravel to sand and silt. As mentioned below, this reach receives turbid flows from Algona Creek (tributary 0054), which flows into Mill Creek a short distance upstream; much of this sediment settles near the lower end of this reach and in the Neely reach downstream. Flashy peak flows from Peasley Canyon upstream have carved a two-stage channel through the upper half of this reach. The streambed lacks LWD but contains moderate amounts of small woody debris (SWD). It has since developed a semi-mature even-aged alder canopy in addition to a pre-existing mature cottonwood stand. Many of the alders have died in recent years due to a change in hydrologic conditions possibly induced by sediment deposition and increased frequency of over bank flows. The understory ranges from dense salmonberry and willows adjacent to the stream to sparse red elder, Indian plum, and giant knotweed farther away from the channel. The remainder of the site is vegetated with patches of weedy upland species interspersed with wetland emergent species in the remaining marshy areas. WDFW plants coho fry annually during the spring in this reach and at several locations downstream. During the 1990's the size of the plantings has ranged from 36,000 to 90,000 fish (C. Baranski, WDFW, pers. comm., 11/22/95).

Stream Restoration Recommendations: The upstream end of the filled area could be excavated to create an off-channel dendrite to improve fish habitat and flood storage. Along with this work, some of the mounds of dredge material should be removed, although care should be taken to retain those on which trees are growing. LWD should be added to the stream channel and the wetland (including the vernal pool area) to increase the structural diversity of the instream and adjacent wetland habitats. The existing riparian forest and the retained mounds should be planted with conifers to provide for long term LWD recruitment to the stream. The upland portions of the site should be planted with a mixture of shrubs, deciduous trees and conifers to provide buffers.

Wetland Restoration Recommendations: Flood storage could be increased and habitat restored if some or all of the fill material were removed. However, part of this fill site provides shallow vernal pool complexes which are good for amphibian breeding. Therefore, consideration should be given to retaining some of the fill on which these pools are perched. The remainder of the site should be planted with trees, except for a pond in the southwest corner which can be enhanced



for waterfowl. An upland buffer should be provided by planting trees and shrubs along the highway that border the east and west sides of the site.

### **Mill Creek, RM 6.0-6.1**

This reach extends from the north end of Wetland S-5P to the confluence of tributary 0054. The creek is channelized and culverted under two roadways. The open area between the two roadways is devoid of riparian cover.

Stream Restoration Recommendations: Restore riparian vegetation in this reach.

**Algona Creek, Tributary 0054, RM 0.0-0.35** (Lower Reach), also Associated Floodplain Upland UP5S (RM 0.0-0.09)(12.6 acres)

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5S	22.3	Yes	No	2	28	Low

Stream Conditions: The streambed in this reach appears to consist of a deep deposit of muck (i.e., decomposed plant materials). The lower 0.2 mile has been channelized into a broad ditch that is choked with reed canarygrass and overhung by occasional clumps of shrubs. The ditch is periodically dredged, causing acute episodes of resuspension of flocculent fine organic material. From RM 0.3 to 0.5 the stream flows through a shrub-fringed cattail marsh (Wetland S-5S). In addition to low dissolved oxygen, this tributary exhibits a high organic suspended sediment load, even under slow-velocity baseflow conditions; the source is suspected to be deep deposits of organic soils formed within ancient wetlands at this location. Up to two cfs of total discharge appears to stem from groundwater upwelling through these organic soils.

Stream Restoration Recommendations: Define and address the source of suspended sediments. Excavate a two-stage channel and a dendrite to reconnect the stream with its floodplain and increase flood storage. Add LWD, clear and control exotic vegetation, and plant native trees and shrubs to restore riparian habitat.

Wetland Conditions: Wetland S-5S is composed of one forested and two emergent/scrub-shrub areas. During the winter the stream often floods into this wetland which serves as a flood storage area. The habitat is relatively poor due to domination by reed canarygrass. The forested area

contains cottonwoods and alders of up to 40 years in age, and a dense shrub understory. The north end of the site is bordered by a filled, asphalt, covered former commercial site, possibly a defunct gas station.

Wetland Restoration Recommendations: Clear and control exotic vegetation and plant emergent vegetation, shrubs, and trees. Remove the asphalt and at least some of the fill and restore native wetland and riparian vegetation.

**Algona Creek, RM 0.35-0.75 (Middle Reach)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5K K K K K	7.6	Yes	No	2	28	Low
5L L L L L	6.3	Yes	No	2	28	Low

Stream and Wetland Conditions: This reach has been channelized into a ditch that conveys only modest flows from eastern Algona. The more northerly of the two Auburn 400 ponds, Wetland 5K K K K K, was mapped as an open water/emergent wetland, but has an equal proportion of scrub-shrub. Although it is one of the more diverse wetlands in the valley portion of the SAMP, it receives surprisingly little waterfowl use. King County staff found that this wetland and 5L L L L L are very low in dissolved oxygen (DO). This and the scummy, polluted water originating in Algona may explain the apparently low wildlife utilization. Alternatively, the open water area in the wetland may not be sufficiently large or vegetated to suit the needs of waterfowl. Pollution may also limit plant growth. Other birds that have been observed here include American bittern, common yellowthroat, and red-winged blackbird.

The more southerly of the two Auburn 400 ponds, Wetland 5L L L L L, is very similar in character to Wetland 5K K K K K except that its primary source of water is from the western portion of Algona and it has a smaller proportion of open water and a higher percentage of shrubs. Like Wetland 5K K K K K, it has low DO and few waterfowl.

Stream and Wetland Restoration Recommendations: Investigate the source(s) of pollution in this reach of Algona Creek. Excavate a low flow channel around the Auburn 400 ponds (Wetlands 5K K K K K and 5L L L L L), which discharge oxygen-deficient water into Mill Creek. The feasibility of aerating the pond outlets and introducing cold, clean groundwater into this reach should be explored.

**Algona Creek, RM 0.45-1.0 (Upper Reach)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5U	7.4	No	No	3	21	Medium
5V	12.8	No	No	2	26	Low
5W	24.3	No	No	2	26	Low

Stream and Wetland Conditions: This reach which originates in a reclaimed quarry in a ravine that incises the west valley wall and has been channelized into a ditch that conveys only modest flows. Wetland 5V is a complex of four emergent and two emergent/scrub-shrub wetlands west of Algona Boulevard in Algona. Nearly the entire area between 8th Avenue N., the southern boundary of the SAMP area, and Boundary Boulevard was very wet in the recent past and probably functioned as a flood storage area. Housing, roads, and other fills have fragmented the remaining wetlands. Wetland 5V drains into the southernmost of the Auburn 400 ponds (Wetland 5LLLL), while the other portion (5W) drains into the northern Auburn 400 pond (Wetland 5KKKK). Despite the fragmentation, it appears the wetlands are all hydrologically connected through drainage ditches. The remaining areas are used mainly for pasturing, and consist mainly of pasture grasses. Shrubs are primarily willows but also include elderberry and red-osier dogwood. Birds observed include willow flycatcher and common yellowthroat.

Wetland 5W which lies east of Algona Blvd., is a complex of eight emergent, three emergent/scrub-shrub, and one forested wetlands. The ditches in these wetlands drain into the northern Algona 400 pond (Wetland 5KKKK) but appear less effective than those that drain Wetland 5V, as some of them have red, flocculent stagnant water.

Stream and Wetland Restoration Recommendations: The source of pollution should be investigated. Some habitat restoration (e.g., LWD addition and revegetation) and water quality improvements (e.g., source identification and treatment) may be possible in conjunction with the City of Algona's current WDE FCAAP grant. The remaining wetlands may be suitable for conversion to stormwater detention ponds. This may require construction of berms to hold additional water, and/or grading these wetlands to create more storage volume and reduce the water quality problems.

**Wetland Conditions, Wetland S-5U:** This is a system consisting of two emergent wetlands. Site visits disclosed the presence of numerous tree stumps, mostly alders, indicating that this system used to be a forested swamp. The site has been cleared, partially filled, and ditched to drain it. The primary water source appears to be groundwater, as there is no apparent inlet. The vegetation still includes species typically associated with forested habitats, such as small-fruited bulrush and skunk cabbage (*Lysichiton americanum*). Spirea is quickly invading the site, which is otherwise dominated by reed canarygrass and evergreen blackberries.

**Wetland Restoration Recommendations:** Block the ditches to increase depth and frequency of inundation. Replant with native trees (cedar, cottonwood and Oregon ash) to restore the forest. More analysis is needed to determine how much water could be added without adversely affecting recent developments, and whether blocking the ditches would affect the regional drainage system.

**Algona Creek, RM 1.0-1.8** (Upper Reach); Associated Wetlands SAMP5 (RM 1.56-1.72); SAMP6 (RM 1.73-1.8)

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP5	6.4	No	No	1	39	Low
SAMP6	0.9	No	No	2	23	Low

**Wetland Conditions: Wetland S-SAMP5:** This is a rather diverse wetland system composed of forested, scrub-shrub, scrub-shrub/emergent, and open water areas. The nearly mature cottonwood forest also contains a few Western red cedars, Sitka spruce, Western hemlock, and alders. The trees average about 50 years in age, though some of the cedars may be over one hundred years old. Wood ducks and mallards have been seen on the pond during several site visits; this is the only wetland in the SAMP area where wood ducks have been observed. The scrub-shrub area is dominated by willows; the scrub-shrub/emergent area contains salmonberry, reed canarygrass, skunk cabbage, and young alders. The swamp has pockets of permanent pools and hummocks that support cedars and spruce. There is no apparent inlet or outlet; the primary water source appears to be groundwater. Human disturbance is evident in the form of ditching, fencing (adjacent to and across the pond), and tree cutting. A fair amount of trash has been deposited in the south end of the pond. Livestock use (probably horses) has removed all woody shrubs along the western shore of the pond.

Wetland Restoration Recommendations: Preserve and restore by eliminating livestock use and planting the shoreline of the pond with riparian vegetation. Install wood duck nest boxes to encourage nesting; and plant aquatic food plants for wood ducks and mallards. An attempt could be made to eliminate the reed canarygrass. Finally, the hydrology of the area should be investigated to learn better the water levels of this wetland at various seasons, including what function, if any, the ditch performs; restoration could be planned after more information has been gathered about seasonal water levels.

Wetland Conditions, Wetland S-SAMP6: This is a small wetland system composed of an open water and a forested/scrub-shrub area about 30 feet west of SAMP5. There is no apparent inlet or outlet; like SAMP5, it may be groundwater fed or an artifact of berm construction between these two wetlands. Houses with landscaped yards border the wetland edge. A small amount of soft rush fringes the shoreline. At the southern edge of the pond is a small stand of alders and willows.

Wetland Restoration Recommendations: None. The restoration potential is limited due to its small size and use as a residential pond.

**Mill Creek, RM 6.1-6.2 (DOT Park and Ride), Associated Floodplain Upland UP5R (2.7 acres)**

Stream and Wetland Conditions: This reach lies within the historic alluvial fan in Upland 20 at the mouth of Peasley Canyon. In addition to the park and ride, this site contains a pool at the confluence of Tributary 0054 that is used by DOT to trap sediment stemming from upper Mill Creek and its steep tributaries. The upper end of the pool is shaded by mature trees and overhanging shrubs. The downstream end is more open. In spite of DOT's periodic maintenance activities, this reach is heavily used by coho fry and could be restored. Due to construction of larger park and ride facilities at the Auburn Supermall and potential future construction of a transportation hub in Auburn, the park and ride may be removed in the future, freeing up this site for restoration or enhancement.

Stream and Wetland Restoration Recommendations: Remove the park and ride fill along both banks and regrade the site to form an alluvial fan where sediments can deposit and be removed with fewer impacts than currently occur. Revegetate with native shrubs and trees to recreate a broad vegetated riparian area. Add LWD to the existing pool to provide cover and hydraulic refuge for salmonids. Plant willows and alder in areas that would be periodically disturbed by

maintenance activities, and conifers and big leaf maple in marginal areas not subject to these impacts.

### **Mill Creek, RM 6.2-6.8 (Lower Peasley Canyon)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5R	22.8	Yes	No	2	43	Low

**Stream Conditions:** The lower end of this reach flows near the north side of Wetland 5R. The upstream, riparian segment of this wetland straddles the stream channel. The gradient is fairly steep in this reach, which descends through Peasley Canyon. The streambed consists of cobble and gravel, with some recently introduced, well anchored LWD; as such it provides the only significant stretch of spawning habitat in Mill Creek. WDFW conducts weekly coho salmon spawning surveys from RM 6.0 to 6.7 from mid-October through December. Segments of the channel have been channelized and much of the stream's former floodplain and Wetland 5R have been displaced as a result of road construction. While the right bank has generally good vegetative cover and a fairly broad forested riparian zone, the left bank has been affected by road shoulder stabilization elements (riprap and log cribbing interspersed with bank logs and planted vegetation). Dissolved oxygen is relatively high (above 8 mg/dl) in this reach, even in the late summer and early fall.

**Stream Restoration Recommendations:** At a minimum, additional LWD could be added to the current alignment. There is also limited opportunity to realign segments of the stream back into its former channel further away from the road. Short of elevating SR-18 on pilings, little more could be done to restore the former floodplain and riparian corridor along the left bank in this reach.

**Wetland Conditions:** Wetland 5R is well known locally as "Blue Heron Marsh", and is monitored by a local Audubon Society chapter. The system consists of an approximately three acre pond, with aquatic beds and cattails, and shrubs and trees around the shoreline. The forested area consists almost entirely of alders, with an understory dominated by salmonberry. A nesting colony of up to 40 pairs of great blue herons is on the hillside above the pond. The herons frequently feed in the pond. Mill Creek flows adjacent to this wetland, but is not connected with it except during very high flood events. The forested area is adjacent to Mill Creek in its steepest reach. This portion of the wetland is a "typical" overflow forest dominated by cottonwoods and

alders, with heavy siltation over the forest floor. The understory is dominated by salmonberry, but also has a high percentage of reed canary grass, particularly where the overstory is relatively open. This forest clearly has a history of human disturbance, with evidence of at least two roads running through the area; both are now covered with vegetation, though the vegetation is mainly herbaceous. The forest and its understory are showing signs of recovery, having been free from human disturbance for several years. Although the vegetation diversity is quite low, structural diversity is high, with trees of all sizes, snags, and fallen logs.

Wetland Restoration Recommendations: Realign channel so the creek either flows through the wetland or at high flows floods the wetland. In addition this system could be better for wildlife--bulrushes could be planted along the shoreline of the pond, as well as additional aquatic bed species; some alders could be replaced with cottonwoods and Oregon ash, and perhaps bitter cherry. Water levels are probably adequate; raising them for any length of time could kill alders and salmonberries, and may make the pond too deep for heron foraging.

#### **Mill Creek, RM 6.8-7.6 (Upper Peasley Canyon)**

**Stream Conditions:** The stream flows through a series of flumes and culverts that prevent access of anadromous fish to historic habitats on the west Auburn plateau. Erosion and sloughing of the ravine walls causes chronic sedimentation of downstream habitats.

Stream Restoration Recommendations: None. Restoration of fish passage in this reach would require either elevating SR-18 on pilings and restoring a semi-natural channel and modest floodplain, or constructing a one mile long fish ladder. Neither option would be cost-effective.

#### **Lake Geneva Tributary 0051A**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP9	0.7	No	No	2	32	Low
SAMP4	2.6	No	No	3	20	High
SAMP3	1.1	No	No	3	20	Low
KCMC9	33.0	No	No	1	35	Low
KCMC8	8.0	No	No	2	32	Medium
SAMP2	2.0	No	No	2	43	Medium
SAMP1	1.3	No	No	1	31	Low

Wetland Conditions, SAMP9: This wetland is a swamp containing Western hemlock, Douglas fir, and Western red cedar. The forest probably has standing water during heavy storms, although a ditch connecting the wetland with Mill Creek was recently dug that may prevent prolonged inundations. The primary sources of water are groundwater and runoff from upslope, including an adjacent pasture which has also been ditched to flow into this wetland. Construction of a house has occurred next to the wetland, reducing the buffer. The wetland is still of high quality, with a good diversity of understory vegetation. It serves to detain and bio-filter stormflows to the valley.

Wetland Restoration Recommendations: Preserve and protect from further human encroachment.

Wetland Conditions, SAMP4: Like SAMP3, this forested wetland is sloped, but it may have standing water; the presence of a large ditch (four to five feet deep and four to five feet wide) is evidence that the area may have been inundated regularly in the past. This wetland has been significantly altered through removal of understory vegetation--in fact, only two species of shrubs were found during the site visits. The trees are immature cottonwoods and alders. Wildlife habitat value is limited by the lack of understory and ground vegetation, and by the lack of structural diversity.

Wetland Restoration Recommendations: Establish a defined trail system and block off and revegetate excess trails and clearings. More analysis is needed to determine the possible benefits of plugging the ditch to increase depth and frequency of inundation.

Wetland Conditions, SAMP3: This wetland contains forested and scrub-shrub areas. The scrub-shrub area is a dense thicket of spirea and Himalayan blackberry, with a few Oregon ash and alder trees. The forested portion consists of immature cottonwoods, alders, and Oregon ash. The forest understory has been largely cleared, and only sparse salmonberry and remnants of a few other species remain. There are no snags or other features that contribute to good wildlife habitat. The swamp shows signs of human intrusion. The forested area is sloped and probably never has standing water, except for a small portion at the bottom of the slope. The scrub-shrub area appears to have standing water much of the year--very likely due to a high water table.

Wetland Restoration Recommendations: None.



Wetland Conditions, KCMC9 (Lake Geneva): Almost the entire shoreline of Lake Geneva is surrounded by houses and roads. The northern end of the lake is a deciduous forest with a scrub-shrub understory and some open water. The forest shows signs of heavy intrusion by people; many of the trees have broken branches and few shrubs remain in the trampled understory. Because of the adjacent land uses the buffers around the lake range from narrow to nonexistent.

Wetland Restoration Recommendations: The forest at the north end of the lake could be restored by establishing one or two well-marked trails, posting interpretive signs, and fencing off and revegetating excess trails and clearings. The shoreline residents should be contacted to determine whether any landowners are interested in revegetating a portion of their yards with native vegetation.

Wetland Conditions, KCMC8: This wetland is composed of emergent, scrub-shrub and forested habitats. Much of the vegetation remains in a relatively natural condition despite development pressures on all sides. The main exception is that the emergent marsh consists mainly of toad rush (*Juncus bufonius*), an introduced species. The willows in one of the scrub-shrub areas have a remarkable number of aerial roots, indicating high water (up to 12" deep) during the early growing season in most years. Water levels within the system decrease during the summer, although the soil remains moist and spongy. Many snags punctuate this wetland. The soils of the system are organic, but there is too much spirea for the system to be a category I wetland. A narrow, ten-foot high upland "ridge" vegetated with Douglas fir divides one of the two scrub-shrub forested areas, adding to the diversity of the system. Water appears to enter the north end of the wetland under Highway 18; an outlet drains to the south through pastures, eventually entering Mill Creek in Peasley Canyon. The system has good wildlife values. During a December 1991, site visit 90 green-winged teal, 12 mallards, eight northern shovelers, two northern pintails, and three gadwalls were present on the emergent wetland. In October 1991, a great blue heron, 12 cedar waxwings, and several other birds were present.

Wetland Restoration Recommendations: Investigate the feasibility of altering the outlet to hold water later into the summer to encourage waterfowl nesting. Some of the spirea could be removed and replaced with more "wildlife-friendly" species. Fence to exclude livestock and revegetate the riparian area.

Wetland Conditions, SAMP2: This system is composed of two forested, one open water, and one emergent areas. A ditch drains north to Lake Geneva. Features of the understory and ground

condition clearly indicate that water is present at times every year. The pond likely provides feeding and resting habitat for a small number of ducks. The forest contains tall cottonwoods and alders of up to 50 years in age. The understory is fairly diverse, but is dominated by buttercups, reed canarygrass, and other exotic pasture grasses. The structure of the system is fairly diverse, with moderate interspersed and many dead trees.

Wetland Restoration Recommendations: Clean up trash and plant conifers to diversify the forest.

Wetland Conditions, SAMP1: This small forested wetland receives both seasonal groundwater and surface runoff. The outlet drains north through a culvert under an adjacent street into a much smaller segment of this wetland. The forest consists of mature alders and cottonwoods that average 50 to 80 years in age; some may be older than 80 years. The scrub-shrub understory is fairly diverse, but the ground cover is sparse. No wildlife species or sign were observed on either of two visits, possibly due to the adjacency of roads and houses. The buffer is not of high quality.

Wetland Restoration Recommendations: None. The wetland is disconnected from other wetlands by roads and houses.

### **Mill Creek Tributary 0051B**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP8	0.8	No	No	2	24	Low
SAMP7	4.8	No	No	2	35	Low

Wetland Conditions, SAMP8: This small forested wetland has some tall cottonwoods over 50 feet in height, and a dense understory of salmonberry and horsetail. The wetland is sloped and drains south into a ditch that flows into SAMP7. Structural diversity is relatively low; as a result this wetland has limited habitat value for wildlife.

Wetland Restoration Recommendations: None.

Wetland Conditions, SAMP7: This forested wetland contains mature and semi-mature cottonwoods and Douglas firs growing on hummocks. The understory is relatively diverse, with

several shrub and groundcover species. There is little evidence of standing water, though at least one ditch drains the area. The wetland is entirely surrounded by roads.

Wetland Restoration Recommendations: None.

### **Mill Creek Tributary 0051C**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP14	12.9	No	No	4	6	High
SAMP11	0.3	No	No	2	40	Low
SAMP13	0.3	No	No	2	31	Low
SAMP17	1.8	No	No	2	26	Low

Wetland Conditions, SAMP14: This heavily disturbed system consists of emergent, forested, and open water areas at the head of tributary 0051C. The emergent area was once a peat bog (and may still retain much peat), but it has been converted to pasture land. This area is so heavily grazed and trampled that it can be accurately described as a mud wallow. The forested portion, while still retaining most of the trees mainly cottonwoods and Douglas firs on hummocks, has been disturbed by house construction, filling, dredging/ditching, and tree cutting. The pond appears to be a man-made. It is fairly natural in appearance and has an aquatic bed, but it lacks shoreline vegetation. Burrows of mountain beaver (*Aplodontia rufa*) exist along the hilly edges of the forested wetland. Despite human intrusions, there is a good forested buffer around most of the forested portion of the system.

Wetland Restoration Recommendations: Restore the emergent area by excluding livestock, restoring hydrology, and eliminating human disturbance. Reconfigure creek channel. More analysis is needed to assess the feasibility of impounding more water in this system in order to restore the emergent and aquatic bed areas.

Wetland Conditions, SAMP11: This small emergent wetland is dominated by buttercup; some bulrush and reed canarygrass are also present. It is situated at the base of a grassy sloped pasture, adjacent to a road--thus it collects runoff from upslope areas.

Wetland Restoration Recommendations: None, due to its small size and location.

Wetland Conditions, SAMP13: This system is a tiny man-made livestock watering pond surrounded by a ring-dike in the middle of a pasture. The pond is surrounded by a ring-dike. Water flows into the pond during storms, and a French drain tile at the outlet end provides drainage. The wetland lacks vegetation due to heavy grazing, thus its wildlife habitat value is limited.

Wetland Restoration Recommendations: None.

Wetland Conditions, SAMP17: This forested wetland has a relatively sparse understory and an overstory of scrawny trees comprised mostly of cottonwood and alder. The surface was dry during a December 1991 site visit, but blackened and mud-stained leaves, water lines on trees, and buttressing on some of the tree trunks are strong evidence that the wetland remains inundated for relatively long periods of time. The site is almost totally surrounded by upland forest, which increases its value to wildlife. There is little evidence of human disturbance.

Wetland Restoration Recommendations: Preserve.

## Mill Creek RM 7.6 to 8.2

Stream Conditions: The creek is in a relatively natural channel of moderate gradient up to RM 7.8. Beyond RM 7.8 the floodplain widens, and coniferous forest cover increases.

Wetland Conditions: The exact extent of these headwater wetlands is not known, but it is greater than shown on the inventory map. One reason for this is that inventory techniques based on aerial photography tend to underestimate the size of forested wetlands. In addition, more wetland areas likely exist downstream to South 321st Street.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP18	2.0	No	No	2	24	Low
SAMP19	0.4	No	No	1	38	Low

Wetland Conditions, SAMP18: This mature forested wetland has trees over 80 years of age. In addition, it's forest is virtually undisturbed, and has good buffers. Mill Creek flows through the center of this site. In less urbanized settings, wetlands such as this typically have high value for wildlife such as black-tailed deer, black bear, furbearers such as mink, as well as waterfowl such

as wood ducks and mergansers. Small mammals, occasional deer, and a variety of bird species still use this area. This wetland provides stormwater biofiltration and reduces flooding in Peasley Canyon downstream. **This wetland serves as an example of what effective Mill Creek buffers should look like if the SAMP is implemented.**

Wetland Restoration Recommendations: Preserve.

Wetland Conditions, SAMP19: This tiny wetland has unusually high habitat diversity due to the presence of open water, aquatic bed, and emergent, scrub-shrub and forested components. It also has high plant species diversity, buffers, and connectivity to Mill Creek and other habitats. The forested portion of the wetland is relatively undisturbed and mature and likely provides good wildlife values. There are several houses nearby. In addition a rock dam topped by a road has been constructed across the wetland, some trees have been cut, and livestock grazing occurs on a portion of the wetland. This wetland is separated from SAMP18 by a ridge of higher ground; it flows into Mill Creek just downstream from the outlet of SAMP18.

Wetland Restoration Recommendations: Install fencing to exclude livestock and install wood duck nest boxes.

### **Mill Creek Tributary 0055**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP20	1.6	No	No	2	39	Low
KCMC5	3.2	No	No	3	17	Low

Wetland Conditions, SAMP20: This emergent wetland consists almost entirely of reed canarygrass and is situated under a high voltage transmission line. Thus, it is a classic example of a category IV wetland under the WDE rating system. It lies on a south-facing slope, and, during a December site visit was quite dry. Because of ongoing clearing for the transmission line right-of-way there are no trees and shrubs within the wetland or its buffer. However, the wetland may provide some erosion and sediment protection for Mill Creek.

Wetland Restoration Recommendations: None.

Wetland Conditions, KCMC5: This scrub-shrub/emergent wetland at the head of tributary 0055 has muck soils and is dominated by spirea. It receives stormwater from surrounding roads and residences, but tends to dry up in the summer. Trash has been deposited in some areas.

Wetland Restoration Recommendations: Preserve and clean up trash. More analysis is needed to assess the feasibility of impounding water in this system in order to diversify the plant community and improve wildlife habitat value.

#### **Mill Creek RM 8.2-8.5**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP21	4.7	No	No	0	4	Low

Wetland Conditions, SAMP21: This system is composed of forested, emergent, and scrub-shrub habitats. A narrow lobe of trees and shrubs extends in a northwesterly direction along a quarter-mile channelized segment of Mill Creek below the outlet of Lake Doloff. The shrub component has been nearly cleared in some stretches, and streamside vegetation is spotty. Only a few trees remain, mostly cottonwoods. The emergent wetland is actually a widened segment of Mill Creek that is bordered by a residence on one side, and a power line on the other. The forest understory has been replaced by a lawn which is mowed on a regular basis. The trees are relatively large and old, but provide little functional value due to the loss of understory components. The only buffer is the cleared transmission line right-of-way to the south. Because of these alterations, this site has little value for wildlife. Its flood attenuation and biofiltration values are likewise reduced due to the channelization of the creek.

Wetland Restoration Recommendations: Plant trees and shrubs along the channelized stream to provide food and cover for wildlife and improve buffer functions.

#### **Mill Creek RM 8.5-8.96 (Lake Doloff)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
KCMC4	36.0	No	No	2	32	Low

Wetland Conditions: Although almost entirely surrounded by houses, Lake Doloff is bordered in a few places by emergent wet meadows, open water areas, and a small scrub area. The northwest

end of the lake was at one time a complex of peat bogs, which have been virtually mined out. Part of this area has been converted to open water ponds separated by dikes. Wet meadows on the east side of the lake are dominated by reed canarygrass and other exotics. Despite nearly the entire shoreline having been developed with either houses or roads the following wildlife were observed on the ponds during a December 1991 site visit: a Pied-billed grebe, mallards, American widgeons, ring-necked ducks, buffleheads, common mergansers, an American coot and a red-tailed hawk. Part of the reason for wildlife use is that power boats are not allowed on the lake.

Wetland Restoration Recommendations: Plant the wet meadows with sedges to restore marsh habitat. Plant shrubs along the open water area shorelines to improve habitat diversity.

### **Mill Creek Tributary 0051D**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
SAMP22	9.9	No	No	2	32	Low
SAMP23	0.6	No	No	2	29	Low
KCMC2	3.1	No	No	3	6	Low
SAMP27	1.6	No	No	3	8	Low

Wetland Conditions, SAMP22: This wetland consists of emergent, forested, and open water habitats. The entire system has Seattle muck soil. Although the emergent area has been converted to a blueberry farm -- a monoculture with little wildlife value -- the remainder of the system has high value for wildlife and other functions. Both ponds, particularly the southeastern one, which is surrounded by a forested swamp, have the potential to support nesting wood ducks. Beavers may also use the system, though evidence of beaver use was not detected on several site visits. Foxes and coyotes have been observed by local residents. The northern pond used to be connected to the system via an open stream channel, but a number of years ago the stream was enclosed in a pipe.

Wetland Restoration Recommendations: Clean up the trash in the ponds and forested area and educate local residents about adverse impacts of trash dumping.

Wetland Conditions, SAMP23: This small emergent/open water wetland is surrounded by a housing development. The wetland's main function appears to be stormwater detention for the

development; there appears to be regular maintenance of culverts leading into and out of the wetland. Wildlife values are probably low due to the small size of the wetland and its proximity to residences.

Wetland Restoration Recommendations: None.

Wetland Conditions, KCMC2: This open water pond at the head end of Mill Creek was once a peat bog, but it was mined and all shoreline vegetation was removed. It is now surrounded by condominiums, and has been modified to provide an aesthetically pleasing landscape component. Storm drains flow into the pond and a pump system may be used to discharge water through the outlet. In spite of these impacts, during a December 1991 site visit at least 67 individuals of 11 species of waterfowl were actively feeding on the pond; apparently the pond has productive aquatic beds which provide a diverse array of feeding opportunities. Among the waterfowl present were plant foragers (Canada goose, mallard, American widgeon, gadwall, ring-necked duck), fish-eaters (hooded merganser), insect eaters (northern shoveler, bufflehead, several others), mollusk specialists (northern shoveler, common goldeneye, bufflehead), and crustacean specialists (common goldeneye, northern shoveler, hooded merganser). This pond clearly is an important feeding and resting area for a diversity of waterfowl, at least during the winter.

Wetland Restoration Recommendations: Plant shoreline vegetation to improve pond's appearance and provide additional cover for wildlife.

Wetland Conditions, SAMP27: This system consists of two small forested wetlands, separated by an old fill. The wetlands are connected by a ditch, which empties into a storm sewer. The trees are primarily younger cottonwoods, with an understory of salmonberry and alder, and a ground layer of sword fern. The wetlands are surrounded by residences, and have been heavily impacted by human intrusion, as evidenced by numerous trails. Much of the understory shrubs have been cut or broken down, and many tree branches have been removed. The wetland does have some habitat value in the form of snags and fallen logs.

Wetland Restoration Recommendations: Preserve. Establish a formal trail system, and block off and revegetate excess trails and clearings.

## **Mill Creek RM 8.96-10.2**



Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
KCMC3	11.0	No	No	1	33	Low
SAMP28	1.3	No	No	2	24	Low
SAMP29	0.2	No	No	3	15	Low
SAMP30	1.0	No	No	3	18	Low
KCMC18	32.4	No	No	1	35	Low

This wetland is composed of emergent, scrub-shrub, and forested habitats approximately 500 feet north of Lake Dolloff. The principal inlet to Lake Dolloff flows through this wetland complex, primarily through the forested portion. This site was catalogued by Rigg (1958) as a peat resource; it still has peat soils. The emergent wetland appears to have been cleared during farming operations years ago; an old farm building still stands on the site. This area is now dominated by reed canarygrass and other exotics. The scrub-shrub area is dominated by spirea and willows, but also contains several other species. The forested portion is dominated by cottonwoods and alders; further upstream (north) are a few Western red cedars and other conifers.

Wetland Restoration Recommendations: Preserve. An attempt could be made to reduce reed canarygrass and replant with native plant species.

Wetland Conditions, SAMP28: This cottonwood/alder forested wetland has been highly disturbed. Most of the understory and ground cover have been removed; the trees that remain are scarred and lower branches have been removed. In addition, some filling has occurred, and hydrology has been altered by home construction, highway and road construction, and ditching/culverting. The primary functions of this wetland are sediment trapping and erosion control, although these functions have likely decreased as a result of ditching and other drainage modifications.

Wetland Restoration Recommendations: Preserve. At a minimum, replant the forest plant community. More analysis is needed to determine the feasibility of restoring former hydrologic conditions.

Wetland Conditions, SAMP29: This tiny forested wetland has a perennial stream running through the center that flows into King County Mill Creek Wetland 3, and then into Lake Dolloff. It is thus positioned at the head of one of the Lake Dolloff subcatchments. The wetland

is relatively undisturbed, although a culvert at its outlet, and an adjacent well, may affect water levels. The vegetation consists of mature conifers, including Western red cedar, as well as shrubs such as elderberry, and invasive species such as evergreen blackberry.

Wetland Restoration Recommendations: Preserve.

Wetland Conditions, SAMP30: This small forested/scrub-shrub wetland is completely surrounded by roads and a residence. No outlets or inlets were found, although old topographic maps indicate this wetland used to drain into a large wetland system about 800 feet to the east. Water-stained tree trunks and leaves are evidence that this wetland floods regularly and probably for extended periods. Trash and old car bodies have been deposited on this site.

Wetland Restoration Recommendations: Remove the trash and car bodies and revegetate denuded areas.

Wetland Conditions, KCMC18 (Camelot Marsh): This system has five wetland habitat classes: open water, forested, scrub-shrub, scrub-shrub/forested, and forested/scrub-shrub. It lies within a residential development and is a King County park. It's large size, the presence of peat soils, mature trees, including some large conifers, and absence of exotic species are indicative of high wildlife habitat value.

Wetland Restoration Recommendations: Preserve. Clean up trash and educate local residents about the adverse impacts of trash dumping.

**Off-Corridor Wetlands East of Mill Creek (S-5C; S-5D; 5F; 5H; 5SSS; 5L; 5EEE; 5ZZZ; 5Q; 5M; 5N; 5O; 5EEEE; 5T):**

This section describes various wetlands located east of Mill Creek which are hydrologically connected to the creek but do not have visible channels.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5C	32.4	No	No	3	21	Medium

This system has two segments and consists of three emergent and two open water areas between the railroad tracks north of 37th St. NW and south of S. 285th St. The area historically was used

for pasture and row crops. The southern segment was recently used as a mitigation site for a large fill to the south and west. The mitigation consisted of excavation of a large open water pond surrounded by reed canarygrass and evergreen blackberry, with small upland buffers. Most of the woody vegetation is still small, and much of it has died, so at present there is little in the way of shrub habitat. The pond appears to be stagnant, as it is dominated by a green alga; an algae-filled ditch leads west from the pond, but was not designed properly. As a result, water simply sits in it and evaporates before reaching the end of the ditch. Waterfowl do utilize the pond, including green-winged teal, mallards, and gadwalls--but its continuing value is questionable without active management. The northern segment of the system (which is the larger of the two segments) is entirely emergent. The eastern half is actively cropped, and annually tilled. The western half is quite wet and possibly has shallow standing water through the summer. Ponding on this site is quite possibly the result of the recent fill immediately to the south.

Wetland Restoration Recommendations: A more active approach to management of the mitigation site is needed. The ditch should be reconstructed to increase the water quality and quantity. Native wetland plant species should be planted around the pond. The wet pasture could be improved by assuring a consistent water supply and planting sedges. With appropriate design and construction this site could be an excellent rail marsh, and possibly provide nesting habitat for blue-winged teal.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5D	30.2	No	No	3	15	High

This system is mapped as one large wetland and four small ones within which are nine emergent areas and one forested area. One of the "emergent" areas is actually dominated by wild rose and should be mapped as scrub-shrub. Another is dominated by evergreen blackberry. There is no inlet, and drainage ditches effectively drain the system to the south toward the storm drain at S. 37th St. A few small isolated wet areas remain vegetated with native wetland plants; due to their small size and shallow water depth, however, they are low in value to wildlife and provide little flood storage. The system supports an abundance of small mammals, even though the dominant vegetation consists of reed canarygrass and pasture grasses. Since the site visits occurred, the three westernmost emergent wetlands in this system have been filled and built on and; the small forested wetland is now adjacent to a parking lot.

Wetland Restoration Recommendations: Block the drainage ditches to increase inundation to a depth of about three to six inches and, hold water for as long as possible through summer. Plant sedges to restore marsh habitat, and shrubs and trees in patches and around the margins to increase interspersation. Install down and standing logs and snags to provide perches for raptors and other wildlife species.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5F	5.9	No	No	3	13	Low

This small system is mapped as two separate wetlands, one emergent and one emergent/scrub-shrub wetland. However, the emergent/scrub-shrub wetland has been cleared since the mapping and is now bare soil. Although the remaining wetland is principally a wet pasture, a small shrub component of willow exists at one end. The dominant vegetation includes meadow foxtail, bentgrass, buttercup, sedge, and soft rush. A few small mammals utilize the area.

Wetland Restoration Recommendations: Restoration may be infeasible because the water source is questionable. Even if a source could be found, the wetlands are less than two feet lower than the surrounding ground; berms may be required to retain water.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5H	40.8	No	No	3	16	High

This system consists of two emergent areas and an open water pond. Water apparently originates from a spring in the south end of the system, then meanders northwesterly through the system, emptying into a drainage ditch adjacent to the railroad tracks. The channel tends to dry up in late summer; apparently the limited spring volumes are supplemented by precipitation and groundwater. The emergent areas have a higher percentage of native plant species than most of the other emergent wetlands in the SAMP area; in addition, several small pothole areas exist that support wetland-dependent birds. Among these are blue-winged teal, mallard, gadwall, willow flycatcher, marsh wren, common yellowthroat, and red-winged blackbird. The blue-winged teal rarely nests anymore in King County, though it used to be relatively common in the Green River valley. One pair and a single male were observed during a May 1991 site visit; which suggests that nesting may have been occurring. Several other bird species were observed on several visits, including uncommon species such as American kestrel and northern shrike. These attest to the habitat quality and diversity of this site.

Wetland Restoration Recommendations: Although the site already has good existing habitat values, it could be further improved by planting a few trees and shrubs to increase interspersed values and improve the buffers. The site can be enhanced for rails and waterfowl through emergent plantings, creation of potholes, and inclusion of a water control structure to hold water on the site longer. A more dependable water supply would benefit wildlife through the dry summer months.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5M	44.5	No	No	2	24	Medium

This site has been mapped as two separate wetlands that contain emergent, scrub-shrub, forested, emergent/scrub-shrub, and emergent/forested areas. The site may have been grazed at one time, but appears to have been ungrazed for several years. A railroad spur divides the system in two parts, though the character of the habitat is basically the same on either side of the tracks. The ground was quite wet during a June 1991 site visit, and small areas of standing water were found. In places the shrubs form impenetrable thickets; in other places, there are a few widely scattered willows and spireas. The areas mapped as forest consist of only a few medium sized cottonwoods, and scarcely qualify as forest (although, in time, they will grow into mature forests if left undisturbed). Most of the emergent vegetation is dominated by reed canarygrass. There is no inlet, and drainage ditches somewhat ineffectively drain the area. Much of the dense growth of shrubs occurs along the drainage ditches. Some wetland-dependent bird species were observed, including willow flycatcher, marsh wren, killdeer, common yellowthroat, and red-winged blackbird.

Wetland Restoration Recommendations: None. This site has been designated as particularly suitable for the SAMP regional permit due to its proximity to downtown Auburn.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5N	8.7	No	No	4	13	Low

A loose system of three medium-sized and two small, severely degraded impacted wetlands, in the midst of active industrial developments. The largest one (about six acres) has been filled to a depth of approximately six feet, and is currently dominated by small willows and alders, as well as reed canarygrass, Himalayan blackberry, and Scot's broom. The ground cover is sparse, as the

soils are poor and the hydrology has been reduced by filling. One of the smaller wetlands is essentially a remnant (now about three-quarters of an acre) of a slightly larger wetland that was filled during construction of a parking lot. This wetland is surprisingly diverse, despite the dominance by exotic species, due to the presence of a small open water area and dense shrubs, including red-osier dogwood, elderberry, and willows. About half of this remnant has been filled, but the remainder still retains some wetland character. The third wetland in this system (also three-quarters of an acre in size) is on an old fill that has settled forming a depression that now collects water. It has some surprising wetland character despite the disturbance and prevalence of reed canarygrass.

Wetland Restoration Recommendations: None. These wetlands have been designated as suitable for the SAMP regional permit.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5O	3.9	No	No	4	6	Low

This site consists of two separate, severely degraded wetlands in the midst of development. A third area, formerly mapped as part of this system has been converted into a stormwater detention pond. At the time of evaluation it was bare dirt. The remaining wetlands -- each about 2.5 acres in size -- are nearly 100% reed canarygrass, have no inlets or outlets, and seem to be rarely, if ever, wet.

Wetland Restoration Recommendations: None. These wetlands have been designated as suitable for the SAMP regional permit because of their small site, fragmentation and location off the Mill Creek/Mullen Slough corridor.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5FFF	0.7	No	No	3	14	Low

This wetland is about 50% reed canarygrass and 50% young cottonwoods. The topography is rather varied, but water does not regularly enter the wetland--no inlet was found, and there does not appear to be a high water table at this site; however, drainage ditches are present.

Wetland Restoration Recommendations: None.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5GG	3.5	No	No	3	12	Filled

This site has subsequently been filled for the Emerald Downs racetrack. A small detention area approximately 3.5 acres in size remains in the northwest corner of the parcel.

Wetland Restoration Recommendations: None.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5L	31.1	Yes	No	2	29	High

This system is composed of emergent/scrub-shrub, scrub-shrub/emergent, and forested/emergent habitats. The vegetation structure is rather diverse, with pockets of shrubs and trees in the midst of extensive, relatively sparse, reed canarygrass, which apparently is never grazed. The trees are primarily cottonwoods. The shrubs are mostly willows, but also include scrubby alders, elderberry, and spirea. The system is flooded each winter; however, the water is gone by mid- or late April, which discourages nesting by waterfowl and other wetland species. Beavers have built a lodge in this wetland, and red-tailed hawks are frequently observed perching in the cottonwoods. Water is retained on this site until at least late spring making it conducive for nesting ducks. Drainage is mainly to the south into wetland 5EEE. The drainage ditches currently contain an oil film and are colored red. The area has been identified by the city of Auburn as a possible regional stormwater detention area.

Wetland Restoration Recommendations: Block the drainage ditches to increase the water supply in spring and early summer to encourage waterfowl nesting. Some excavation may be needed to attain the desired depth up to 18" and duration of inundation. If possible, retain water year-round to control reed canarygrass. The possibility of using this area as a retention/detention (R/D) facility exists. The impact of stormwater retention on the trees must be carefully assessed if an R/D facility is built here.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5EEE	77.8	Yes	No	3	11	High

This wetland is a large former pasture with a high water table. The east Emerald Downs racetrack mitigation site occupies the south part of this site. A channel on the west edge

transports water both away from the wetland and into the wetland. The mitigation site was formerly mostly pasture grasses, but a much more diverse plant community including native shrubs and marsh species is becoming established following mitigation plantings in 1995. The north half of the site is still lightly grazed. The north half of the site has been identified by the City of Auburn as a potential regional R/D facility site. It appears to receive flood water from Mill Creek on the opposite side of Highway 167.

Wetland Restoration Recommendations: Restoration of the north half of the site should tie into the open water/emergent system restored as mitigation for the Emerald Downs racetrack. Sedge meadows can be created north and south of the existing mitigation site.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5SSS	22.4	No	No	3	16	High

This emergent wetland is surrounded by roads and urban development. Despite ditching on three sides, the wetland retains surface moisture throughout the year and a few depressions may retain water on the surface through most of every summer. Reed canarygrass is abundant; in the wetter depressions, buttercup and soft rush predominate. Two species of small, unidentified sedges were found that likely were much more common prior to drainage of the wetland. Marsh wrens and common yellowthroats were observed during a late May ?? site visit, which suggests that these species may nest on the site. The area has been identified by the city of Auburn as a potential R/D facility site.

Wetland Restoration Recommendations: Additional analysis is needed to determine whether blockage of the ditches would result in attainment of the desired depth (three inches) and duration of inundation without flooding nearby developments. If reed canary grass could be reduced, and small sedges planted to restore their former abundance, this could be an excellent marsh for rails and possibly also blue-winged teal.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5ZZZ	11.4	No	No	3	16	Medium

This emergent wetland has no obvious water inlet. A drainage ditch follows the western edge; which is adjacent to Highway 167. Filling of a portion of this wetland (approximately three acres) just prior to mapping may have affected its hydrology. The wetland is being colonized by



willows, particularly at the south end near the fill. In the north end within about a one acre area of buttercups both a sora rail and a common snipe were flushed during an October ?? site visit. While it is unlikely these birds had nested here, the wetland clearly provides a resting and/or feeding area for them in the fall. The remainder of the wetland is dominated by reed canarygrass, cattails, buttercups, and willows, in about equal proportions. Spirea and soft rush are invading, and a few small clumps of woolgrass (*Scirpus cyperinus*) were found. This area has been identified by the city of Auburn as a possible R/D facility site.

Wetland Restoration Recommendations: Part or all of the site could be excavated to allow shallow (up to 3 inches) ponding through early summer, and planted with small sedges to provide rail and snipe nesting habitat.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5Q	26.0	No	No	3	17	Medium

This wetland is composed of open water, emergent, and emergent/scrub-shrub habitats. The emergent areas were grazed until recently, and are dominated by reed canarygrass, evergreen blackberry, meadow foxtail, buttercups, and pasture grasses. There is no inlet or outlet. A willow-dominated area is about one foot lower in elevation than the emergent areas, and collects water during the wet seasons. However, this area was dry during a June 1991 site visit. A few wetland-dependent birds were observed, including willow flycatcher, marsh wren, common yellowthroat, and red-winged blackbird.

Wetland Restoration Recommendations: Restoration may be hindered by the lack of a water source. Excavate portions of the site to expand the willow swamp. Retain water for as long as possible and plant sedges to restore march habitat.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5EEEE	7.0	No	No	3	9	Low

This overgrazed emergent wetland is dominated by thistle, pasture grasses, dock (*Rumex* sp.), and reed canarygrass. The western end is about three feet higher than the rest of the wetland, and may be an old fill. The wetland is bordered on two sides by Highway 18 and a warehouse, and on the other two sides by a street and a house. There is no water inlet, and no apparent ditches.

Wetland Restoration Recommendations: None. This site has been identified as suitable for the SAMP regional permit because of the adjacent urban land uses and lack of a connection to the Mill Creek/Mullen Slough corridor.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5T	1.9	No	No	0	4	Low

This system consists of two highly disturbed emergent wetlands surrounded by industrial activity. Since the mapping, one of these has been cleared and graded, leaving virtually no remaining vegetation except for a few mustard plants. The other wetland is on a fill, and is 50 percent reed canarygrass and 50 percent thistle (*Cirsium vulgare*). Neither wetland has an inlet or an outlet, and there is no obvious water source.

Wetland Restoration Recommendations: None. Their small size, urban location, highly degraded condition, and lack of hydrology give these wetlands a low potential for restoration.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
3D	3.0	No	No	3	18	Low

This small system is composed of emergent and emergent/scrub-shrub areas. The system is adjacent to the old Auburn sewage ponds to the south, but is hydrologically isolated by a dike. There is no apparent inlet or outlet. The main emergent/scrub-shrub area is dominated by young willows, cottonwoods, locusts, Japanese knotweed, and reed canarygrass. The tiny (about 0.2 acre) emergent area appears to be mostly native wetland herbaceous species. The wetland may have been much wetter in the past. A ditch on the south side currently provides some degree of drainage.

Wetland Restoration Recommendations: None. This wetland is now outside Corps regulatory jurisdiction.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
3E	5.0	No	No	3	21	Low

This system of one emergent area and one forested area is adjacent to the Auburn airport as well as roads and commercial buildings. The emergent marsh is regularly mowed for safety; the forest

is out of the way of the runway flight path. The entire system is drained by a large drainage ditch. The forested area is primarily young cottonwoods, with no shrub understory and low habitat value.

Wetland Restoration Recommendations: None. This site has low restoration potential due to its proximity to the airport and potential to attract birds that could collide with airplanes.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
3Z	37.5	No	No	2	30	Low

This system which is composed of emergent/open water and scrub-shrub habitats was formerly a sewage pond facility. Its mix of permanent water and shrub and emergent habitats still provide some good nesting habitat for waterfowl. However, the water is permanent in only the smallest pond. In fall and winter the other ponds receive water, and support many species of birds, including bufflehead, ring-necked duck, Barrow's goldeneye, dunlin, and common snipe. A weasel was also seen on one site visit.

Wetland Restoration Recommendations: Now outside Corps regulatory jurisdiction. Restoration of this system would require reconstruction of berms and a reliable water supply. Invasive plants such as Himalayan blackberry and (Polygonum persicaria) may also need to be eradicated.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
5I	41.4	No	No	2	23	Low

This system is composed of one large emergent, scrub-shrub, and emergent/scrub-shrub habitats. It is located immediately south of the old Auburn sewage ponds, but is not apparently connected hydrologically to the ponds as it has no apparent inlet or outlet. The emergent wetland is a wet pasture, with a shallow channel running through the length of it; the channel was dry in late October 1991. A few shallow depressions are also present which are slightly wetter and contain more obligate wetland species than the surrounding area. One such plant is Dulichium arundinaceum, a relatively unusual sedge. The scrub-shrub areas are dominated by willows, although they contain several other shrub species. The southern 25 percent of the wetland had recently been filled at the time of a site visit in October 1991. Few wildlife species were observed, in part due to the time of the year. However, western meadowlarks and a northern harrier were active on the site.

Wetland Restoration Recommendations: None. This system is now outside Corps regulatory jurisdiction.

#### **4.6 AUBURN CREEK (WRIA 09.0056) AND ITS TRIBUTARIES:**

##### **Auburn Creek, RM 0.0-0.3 (KC Open Space)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2AAA	2.5	Yes	Yes	2	27	-
2BBB	1.2	Yes	Yes	2	27	-
2ZZ	1.4	Yes	Yes	4	11	Low

Stream Conditions: This reach, which flows through a narrow neck of Wetland 4B in undeveloped King County Open Space, is relatively steep. This stream is seasonal from its headwaters to the mouth. A flap gate at the mouth blocks fish passage except during floods. In 1994 almost the entire reach (RM 0.05-0.30) was dredged, with deposition of spoils along the banks, without the required permits. The violation was documented by WDFW and MIT staff, but no enforcement actions were taken by the county or WDFW. In spite of the above adverse conditions, patches of spawning habitat are present in this reach and in the one just upstream (to RM 0.7) (Jones & Stokes, 1989), and juvenile salmonids (coho, steelhead, and an unidentified trout species) have been observed in and upstream from this reach.

Stream Restoration Recommendations: At a minimum, state and county code should be enforced to require removal of dredge spoils and revegetation of the riparian zone. Install fencing. A more complete solution would entail acquisition of development rights from the FPP and expanding the riparian zone and adding LWD to the stream. As an alternative, large scale excavation can occur in the uplands owned by King County Parks Department (Horsehead Bend) next to the Green River to create side-channels for salmonid rearing.

Wetland Conditions, Wetland 2ZZ: Wetland 2ZZ is a wet area within an upland pasture. It lacks obligate wetland species and the vegetation consists of pasture grasses and weeds. The area is not drained, and it appears to retain surface water during storms. Because of the lack of drainage, grazing animal wastes are largely retained on site, instead of running off immediately into the Green River.

Wetland Restoration Recommendations: Install fencing to exclude livestock during the rainy season.

Wetland Conditions, Wetland 2AAA: This system is a pond with permanent open water within a heavily grazed pasture. The shoreline is devoid of vegetation due to over-grazing. The pond may completely dry out during summer. There is no apparent inlet; the main water source appears to be shallow groundwater; a small outlet drains into wetland 2BBB. Because of the degraded condition of the pond, its wildlife habitat value is minimal; no birds were seen in the vicinity of this pond on either of two site visits.

Wetland Restoration Recommendations: Block or restrict outlet to increase ponding. Install fencing to exclude livestock during the rainy season and restrict access to a single watering area during the growing season to enable revegetation of at least a portion of the pond shoreline.

Wetland Conditions, Wetland 2BBB: This wetland is a pond with permanent open water and abundant shoreline vegetation, particularly the scrub-shrub component. An outlet flows into a drainage ditch, which flows into the Green River. The emergent vegetation includes soft rush and Timothy (*Alopecurus* sp.). The pond has high interspersed values, but appears to be too small and narrow to be of high value to wildlife. Beaver utilize the area, and a barn owl and several other species were observed during a site visit in ??????.

Wetland Restoration Recommendations: Block or restrict the outlet to increase ponding, remove blackberries, and plant additional shoreline vegetation. This pond could also be enlarged to support greater numbers and diversity of wildlife. Install fencing to exclude livestock during the rainy season, and restrict access to designated watering areas during the growing season.

#### **Auburn Creek, RM 0.30-0.60**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
4A	41.5	Yes	Yes	3	10	-
4AA	33.2	Yes	Partial	3	17	Low

Stream Conditions: The downstream portion of this reach flows in a ditch along the east central edge of Wetland 4A. The upstream portion flows through the south end of Wetland 4A.

Extensive, near-annual backwater flooding from the Green River occurs along this reach creating the potential for fish stranding in adjacent agricultural fields.

Stream Restoration Recommendations: If this property can be removed from the FPP, expand the vegetated riparian zone by planting native trees and shrubs, and add LWD to the stream channel.

Wetland Conditions, Wetland 4A: Wetland 4A is a large emergent wetland, used as pasture land. It has no inlet; the outlet drains under SR-167 into Wetland 4AA. Wetlands 4A and 4AA are part of the same system, but are bisected by the highway. Adjacent land use is primarily dairy farming, but busy roads border two sides, and a railroad borders a third side. The Green River flows along the short northern border, but levees reduce flooding into the wetland. During an April 1991 site visit, about one-third of the area was covered with standing water.

Wetland Restoration Recommendations: The restoration potential of this system may be limited by the lack of a reliable water supply. If a water supply is available, flood the pasture at least through early summer (June 30).

Wetland Conditions, Wetland 4AA: This system includes two emergent areas which are over-grazed pastures. As mentioned above, it is separated from Wetland 4A by SR-167. The primary water sources are shallow groundwater, surface runoff, and flow from Wetland 4A. Ditches (which were "cleaned" in 1991) discharge animal wastes from the wetland directly into the Green River. The habitat quality is low due to grazing impacts.

Wetland Restoration Recommendations: Block or restrict the drainage ditches and raise the elevation of the adjacent roads to increase depth and duration of inundation, and restore emergent marsh habitat.

#### **Auburn Creek Tributary 0056A, RM 0.00-0.23**

Stream Conditions: This small stream has been heavily impacted by channelization, dredging and unrestricted livestock access.

Stream Restoration Recommendations: None.

**Auburn Creek Tributary 0056B, RM 0.00-0.25**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
4B	115.1	Yes	Yes	2	32	

**Stream and Wetland Conditions:** This stream flows along the north edge of Wetland 4B. Both the instream and riparian habitat have been severely impacted by ongoing agricultural impacts (tilling to top of bank). Wetland 4B is a large system composed of two emergent, two forested, and one open water habitats. The forested areas are riparian strips along tributaries 0056A and 0056B, which originate within the wetland. The open water is a bermed "farm pond" within the pasture. During heavy rain, several areas of open water appear on the pasture which are heavily used by waterfowl, especially American widgeon and northern shoveler.

**Stream and Wetland Restoration Recommendations:** If the property can be removed from the FPP, excavate a dendrite, add LWD, and revegetate with native shrubs and trees.

**Auburn Creek Tributaries 0056C (RM 0.00-0.25) and 0056D (RM 0.00-0.25)**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2YY	1.48	Yes	No	4	7	Low

**Stream and Wetland Conditions:** These short tributaries have been channelized between the south edge of Wetland 4A and the north side of 52nd Street NE. Wetland 2YY is an emergent pasture that receives surface water and shallow groundwater. A ditch on the north side effectively drains the wetland; because of this standing water is apparently only present during storms. Vegetation is dominated by pasture grasses. The wetland is surrounded by roads, houses, and a small upland pasture; as a result, the habitat value is low.

**Wetland Restoration Recommendations:** None, due to the wetland's small size and the adjacent land uses.

**Wetlands south of Tributary 0056**

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
4C	15.1	Yes	Yes	3	14	Low

This system consists of two emergent areas that have been farmed for many years, and recently purchased for development. Drain tiles have been placed in the area to promote drainage. Investigation for alternatives sites for the Emerald Downs racetrack indicate that a large volume of water does pass through this system in the spring and late winter. Habitat quality is currently low due to agricultural practices and recent inattention. Several bird species were observed, including a red-tailed hawk, but none were wetland-dependent.

Wetland Restoration Recommendations: Restoration of this site may require massive structures (e.g., berms) to hold water. Portions of the site could be excavated to provide salmonid rearing habitat in the form of one or more off channel sloughs and/or side channels adjacent to the Green River.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2CCC	0.6	No	No	3	3	Low

This wetland is an open water pond that had been dredged and stripped of all vegetation just prior to WET functional assessment. In addition, a series of interconnected ponds and canals had been constructed, none of which contained vegetation. The water source appears to be shallow groundwater. No wildlife species were observed.

Wetland Restoration Recommendations: Plant wetland emergent vegetation and shrubs along the margin of the pond and upland trees and shrubs landward of these plantings to provide a buffer.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
2DDD	0.1	No	No	3	5	Low

This tiny emergent marsh lies a short distance south of Wetland 2CCC. It appears to have permanent surface water and some native vegetation, although non-native species (e.g., Timothy, buttercup, and soft rush) are dominant. Filling has occurred nearby, indication that this system may have been larger in the past. There is no inlet or outlet.

Wetland Restoration Recommendations: Remove the adjacent fill and replant with native species. For this to be cost-effective, Wetland 2CCC should be restored as well.



Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
4D	3.0	No	No	4	9	Low

This wetland consists of two small emergent areas surrounded by agricultural land uses. Approximately 50 percent of the mapped wetland is currently part of a truck farm operation and is plowed annually. The other 50 percent is in an unused pasture, and consists primarily of reed canarygrass, buttercup, and soft rush. The water source appears to be shallow groundwater; there is no inlet or outlet. A surprising number of small mammal tunnels were found in this wetland. This wetland appeared to extend a few hundred feet further north than mapped.

Wetland Restoration Recommendations: Ideally, restoration of this system should be tied to restoration of nearby Wetlands 2CCC, 2DDD, and 3N. Excavate to increase depth and frequency of inundation and revegetate with native emergent, shrub, and tree species.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
3N	1.4	No	No	3	19	Low

This wetland has emergent/forested and open water components. The forested portion is a small, dense row of cottonwood, willow, rose, and red-osier dogwood. A truck farm to the east is plowed annually. West of the trees is a small emergent patch of meadow foxtail, at least two sedge species and various other herbaceous species. A culverted outlet limits water depth, and drains to south, possibly toward Wetland 4E. A pair of gadwalls were present during a site visit in 1991.

Wetland Restoration Recommendations: Ideally, restoration of this system should be tied to restoration of nearby Wetlands 2CCC, 2DDD and 3N to improve the existing wildlife habitat.

Wetland	Acres	Floodplain	Farm Prog.	WDE Rating	Points	Rest. Potent.
3Q	2.0	No	No	3	6	Low

Although it is mapped as an emergent wetland this system is a depressional area within a truck farm and is plowed annually. It has no inlet or outlet. This wetland's habitat value is non-existent although it may provide some flood storage value.

Wetland Restoration Recommendations: None, due to the existing land use.

## **5. IMPLEMENTATION OF THE RESTORATION PLAN**

### **5.1 INTRODUCTION.**

Most of the aquatic sites identified in this restoration plan as having high or medium restoration potential, or high existing value, have been incorporated into the recommended alternative #8 of the Mill Creek SAMP for protection and restoration (see main SAMP report). Eventually, elected officials may adopt this or another SAMP alternative. If a SAMP were not to be adopted or implemented, this restoration plan could still be used by any interested party to set priorities for restoring individual sites and to identify what restoration actions are appropriate for each.

If alternative #8 or generally similar alternative would be adopted, acquisition and restoration of some of the restoration sites would occur as wetland, stream, and park conservation funds become available. Other aquatic sites would be acquired and restored to compensate for aquatic function losses on other generally less ecologically valuable aquatic sites on which the SAMP permits development. The aquatic sites included in the SAMP recommended alternative all have roughly equal priority in regard to which ones should be restored before others. The major implementation issue relating to the Restoration Plan is whether aquatic sites would be acquired and successfully restored as anticipated under the SAMP: if not, why not, and what could be done about it.

### **5.2 IMPLEMENTATION PROCESS.**

Once the SAMP is adopted, the Corps and local sponsors would set in motion a process addressing this issue. Major activities would include the following:

#### **5.2.1 Advise Prospective Applicants On Content Of Individual Site Restoration Plans.**

As outlined in the main SAMP report, Section 5.3 (Process of Mitigation Planning) and Section 6.4 (Permit Application Process Description), an applicant would submit an individual site restoration plan as part of their application for any work proposed in SAMP aquatic sites. The Mill Creek SAMP Technical Oversight Committee (TOC) would review individual site mitigation plans and work with applicants to ensure the plans would likely be fully successful. TOC members and the Mill Creek basin steward would be available to provide guidance in the preparation of this document. To help make the determination, the site plan should include the following:

- Baseline data to be used to compare pre- and post-implementation conditions. Especially important would be data on the existing hydrologic regime (seasonal and multi-year groundwater,

surface and soil column hydrology), existing water quality conditions if stormwater discharge is part of proposal, existing topography, and existing biotic communities.

- Site design and management details including restoration goals and objectives, grading plan, proposed hydrologic alterations, planting and habitat creation plan, and reed canarygrass management control approach.

- Performance standards that would be used as basis for monitoring field conditions and determining whether site restoration objectives were being achieved. Measures could cover prospective changes in the hydrologic regime, water quality (especially temperature and dissolved oxygen), wildlife uses, planted species survival and establishment, as-built topography, and vegetation and other changes relative to baseline conditions. Performance standards would specify the season, or time of year or day in which measurements would be made.

- Implementation schedule including a monitoring plan and reporting times.

- Contingency measures and performance bond arrangements.

### **5.2.2 Approve Individual Site Restoration Plans.**

The Corps and local sponsor, with the advice of the TOC, would approve these site plans as described in more detail in Section 5.3 (Process of Mitigation Planning) in the main SAMP report.

### **5.2.3 Monitor Individual Site Restoration Plans.**

The Corps and local sponsor would review permittees' restoration plan monitoring reports and conduct field inspections to determine whether aquatic resources on specific sites are being successfully restored in compliance with the individual restoration plans. When actual results deviated substantially from expected results, the Corps or local sponsor would work with the permittee to determine the reason(s) for the deviation(s). The Corps and/or local sponsor would require remedial actions by the project proponent as required by the terms of the Department of Army Permit, local ordinances, and terms of the approved site restoration plan. The Corps would also maintain a data base for tracking the status of each potential restoration site.

### **5.2.4 Determine Whether SAMP Aquatic Site Restoration Objectives Are Being Attained.**

SAMP restoration objectives are stated in several sections of Chapter 3 of the main SAMP report. The TOC would meet at least annually following approval of the SAMP by at least one sponsor to review data summarized from individual site restoration plan monitoring reports and determine whether, overall, these restoration plan objectives were being attained. Minutes of these meetings would be prepared. The TOC's findings would become the basis for improving TOC's review of

individual site mitigation plans, and for revising the SAMP and or this restoration plan.

Determinations that the TOC would make during their overview would include:

- Whether aquatic sites were being acquired and restored commensurate with the amount of such areas being developed or adversely impacted in the basin.
- Whether net IVA point increases due to restoration were being realized as estimated for the SAMP. If the amount varied substantially from the original estimate, what are the reasons why.
- Whether water quality standards were being met or improving, including especially stream temperature and dissolved oxygen.
- Whether fish populations of various life cycle stages, and fish spawning success were increasing to appropriate levels.

#### **5.2.5 Revise The SAMP And The Restoration Plan.**

The SAMP sponsors (cities, King County, and Corps) may reach a consensus to revise the SAMP or the restoration plan at any time by reaffirming the interagency memorandum of understanding (MOU). The TOC may propose revisions based on the results of its annual review and other changed circumstances.

### **5.3 FUNDING RESTORATION PROJECTS**

Many different sources of funding are available for restoring Mill Creek basin aquatic sites. The single biggest source of funds is anticipated from parties providing compensatory mitigation for developments in aquatic sites, including flood control, both in- and outside the basin. While no commitments have been made as of this writing, a second anticipated source are funds raised from bonds, levies and general revenues by the cities of Kent and Auburn, and King County. A potential third Federal/County funds source would be implementation of the Green/Duwamish Ecosystem Restoration Plan which the Corps and King County currently are preparing. If investigations underway show that this plan would be feasible, Federal funds for restoration of Mill Creek aquatic sites could be provided under authority of Section 1135 of the Water Resources Development Act of 1986, as amended.

General summaries of potential funding sources for watershed restoration and related projects may be found in the following publications: Exploring Wetlands Stewardship: A Reference Guide for Assisting Washington Landowners, (Publication 96-120) by the Washington Department of Ecology (October 1996); Wetlands Preservation: An Information & Action Guide (Publication 90-5) by the

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## RP APPENDIX A RELATIONSHIP TO EXISTING PLANS

### **A.1 RELATIONSHIP TO EXISTING PLANS**

The Mill Creek basin has been the focal point of several plans oriented towards improving one or more functions in the basin (i.e. flood control; water quality). This section reviews the relationship of the restoration plan to several of these other plans.

#### **A.1.1 Mill Creek Water Quality Management Plan**

The Mill Creek Water Quality Management Plan recognizes that retaining as many wetlands as possible is beneficial to water quality and aquatic habitat. The plan calls for improving riparian habitat along Mill Creek, Mullen Slough and other tributaries as well. The plan includes a sample cross section, recommendations for types of plantings along Mill Creek, and recommended plantings.

Other recommendations include improving sediment control, and reducing and treating runoff will aid in improving water quality for the basin's aquatic resources. Implementation of BMPs for agricultural areas including hobby farms will also act to improve water quality. The plan also calls for improving ditch maintenance procedures. While this action could improve water flow, and therefore improve water quality, impacts to the area's aquatic resources (especially fish) could occur if these actions are not implemented in a way which recognizes the sensitivity of the aquatic resources.

Direct modifications to wetlands were also recommended. Channel improvements are recommended for wetlands 5S, 5P, 5K, and 5J (from approximately State Route 18 to 15th St. NW) to improve flow and reduce biological oxygen demand (BOD). Dredging of channels in wetlands 5KKKK and 5LLLL are also recommended to improve water flow and decrease BOD. These actions should work to improve wetland functioning. The plan also calls for construction of a parallel channel to Mullen Slough. This action could impact fish habitat and partially dewater wetlands 2E and 2D.

#### **A.1.2 Green-Duwamish Watershed Non-Point Action Plan**

This plan offers similar recommendations as the Mill Creek Water Quality Management Plan. There is a recommendation in the plan to encourage low-density zoning near streams and wetlands. This recommendation is consistent with the restoration plan, and focuses on minimizing disturbances to the basin's aquatic resources.

### **A.1.3 Auburn Comprehensive Drainage Plan**

The Auburn Comprehensive Drainage Plan recommends collection and treatment of runoff from impervious surfaces. This action will improve water quality in the Mill Creek basin. The plan also identifies regional stormwater detention areas in all or part of wetland systems 5L, 5EEE, 5SSS, 5KKKK, 5LLLL, 5ZZ, 5A, and 4B. These systems already function as de facto storage areas and this action would formalize that function. In improving these facilities, care must be taken not to significantly alter the hydrology of the systems by extending the time period during which water is held in the systems. Extended periods of inundation plus rapid fluctuations ("flashiness") could result in stresses to vegetation cause certain plants to die off. In addition, excavating wetland areas might create habitats that are low in structural diversity and subject to water level fluctuations that impact certain plant and animal species. The loss of emergent vegetation could reduce the ability of wetlands to provide biofiltration of stormwater (SWM, 1993).

The Comprehensive Drainage Plan also recommends diverting water from the southern portion of Auburn in the White River drainage to the Mill Creek drainage (the "Roundhouse diversion"). The influx of additional water to the Mill Creek Basin during flood periods could exacerbate flooding problems as well as alter the makeup of the basin's aquatic resources.

### **A.1.4 Kent Water Quality Management Plan**

The City of Kent has produced a 5-year water quality plan to guide their water quality protection efforts. Included in this plan is the objective of completely restoring Lake Fenwick. This work is already underway (aeration of the Lake), and is consistent with this restoration plan.

### **A.1.5 Mill Creek Flood Control Plan**

This plan is still being developed. However, all alternatives being examined will assess impacts to aquatic resources. The plan is also oriented towards meshing with the Mill Creek SAMP in protecting the basin's aquatic resources. The preferred alternative looks at utilizing existing wetlands for floodwater storage along with channel improvements (two-stage channel similar to the Mill Creek Water Quality Management Plan) to aid in the conveyance of flood water. A two stage channel is called for from the mouth of Mill Creek to approximately RM 3.7. Upstream of this point and on Mullen Slough, improvements to riparian vegetation and construction of only a low flow channel are recommended.

### **A.1.6 Green/Duwamish Watershed Fisheries Management Process**

There is an ongoing process to bring all responsible parties in the Green River watershed together to jointly plan for the fisheries resources of the basin. The objectives of the Mill Creek SAMP Aquatic Resources Restoration Plan are oriented towards improving the fisheries resources of the Green River by increasing refugia habitat in the Mill Creek system, and improving water quality input to the Green River.

### **A.1.7 Green/Duwamish Watershed Restoration General Investigation**

The Corps of Engineers in conjunction with King County Water and Land Resources Division is currently studying possible restoration actions for the entire Green River watershed. Several restoration actions for the Mill Creek basin that are outlined in this report have been recommended to the study proponents to be studied during the feasibility phase of the project. Implementation would be strictly as restoration projects and not tied to any mitigation actions.

### **A.1.8 Mill Creek Basin Reconnaissance Report (1987)**

The Basin Reconnaissance Report was conducted by King County SWM as part the assessment of all the county's basins. The report described basin conditions, as well as possible causes of flooding and environmental degradation in the area. Over 30 projects were recommended, mainly to address flooding and water quality problems. The restoration plan proposes actions which are consistent with the goal of reducing flooding in the basin. However, the specific recommendations of the basin reconnaissance would not be carried out as the main goals of aquatic resources restoration.



## **RP APPENDIX B**

### **WETLAND COMMUNITY TYPES**

**Figure 3-5**

**Plant Community Structure**

**and Interspersion Illustration**

**Figure 3-6**  
**Irregular Shoreline Illustration**

## **Figure 3-7**

### **Two-Stage Channel Illustration**

## **Figure 3-8**

### **Dendrite Illustration**